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Ex Libris
C. K. OGDEN

[illegible]

Ascending the Sea Cliff, to gain the Grand Mulei Rock

below him a Chasm of unknown depth

THE [illegible] GUIDE [illegible]

Passing round the Grand Mulet Rock drawing up the rest of the party

ASCENT

TO THE SUMMIT OF

MONT BLANC

IN

1834.

BY

MARTIN BARRY,

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TO

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&c. &c.

THE FOLLOWING NARRATIVE

IS

RESPECTFULLY INSCRIBED,

BY

HIS FORMER PUPIL,

THE AUTHOR.

The following narrative contains the substance of two lectures delivered in the Assembly Rooms, Edinburgh, in March 1836, for the benefit of an excellent Institution,—the ROYAL INFIRMARY of that city,—in which the author had been a pupil.

PREFACE.

A SHORT account of this ascent of Mont Blanc was published in the Edinburgh New Philosophical Journal, Vol. xviii. No. 35; beyond which,—with the interesting narrative by Auldjo already before the public,—it was not proposed to extend it. But having since been made the subject of two lectures,—in preparing which, some information was collected, likely to be found generally useful,—and as any contribution seems allowable, on the subject of a track so few have taken,—the narrative is now published in a separate form.

The following pages contain the lectures nearly as delivered; with the addition of a short account of the early attempts to reach the summit of Mont Blanc.

The observations on the effects of dimi-

nished atmospheric density on respiration and other functions, are condensed from a paper by the author, lately read before the Royal Society of Edinburgh.

The large drawing appended, will serve,—it is presumed,—as no mean substitute for the model, used at the lectures. The former was executed for me by a talented lithographer;* and the latter by a rising young sculptor, and portrait-modeller:†—both of Edinburgh.

The model has been presented to the Royal Museum of Natural History in the University of Edinburgh,—as a work of art, not undeserving of a place among the works of nature,—and as a production worthy of a Scottish artist.

It covers *forty-eight* square feet. Arthur's Seat,—near Edinburgh,—on the same scale, might be represented by——a mouse.

* Murray. † Slater.

FIRST LECTURE.

Hot summer of 1834—Heidelberg—Fine autumn—Switzerland—Sunrise, and sunset, from the Faulhorn—Arrival at the Col de Balme—First view of Mont Blanc—Goethe's evening approach to Chamonix—Snow-cap of Mont Blanc, and Benlomond—Mont Blanc the most considerable *mountain* known—Chamonix but little known before 1741—Captain Sherwill's sketch of "Chamouni"—Origin of the name "Chamouni"—The summit not wrapped in vapour—Guides consulted at the Priory—their objections—favourable circumstances—Departure for the mountain—Ascent—Pine-Forest—Chalet de la Para—Pierre Pointue—Pierre à l'Echelle—Highest tree—Rhododendron ferrugineum, and other alpine plants—Provisions, &c—Chamois seen—Entrance upon the ice—Iron points for shoes—Nitric acid—Bâtons—The glaciers—transverse rents—lateral debris—slips—Glaciers of Bossons and Taconnaz—Bridges of ice—Crossing the chasms—Narrow crevices concealed—Danger of setting ice in motion—The guides on the glacier—Unseen torrents—Thickness of the ice—Icy desolation of the glaciers—Fissures wi-

dened, from the lateness of the season—Zig-zag course, and steps retraced—Difficulty and danger in attaining the "Grand Mulet" Rock—The guides Couttet and Balmat—The other guides—Couttet had never found the rock so unattainable—Scaling two hundred feet of the Grand Mulet Rock—Open shelf of rock—Sunset—Barometer—Cabin—Thirst—A night at the Grand Mulet Rock—Avalanches—Inability to sleep—Reflections—No fatigue—Thermometer—Moonlight scene at the Grand Mulet Rock—Morning of the second day—Departure from the Grand Mulet Rock—Held in twos and threes with ropes—The way laborious, from recent snow—Splendid icy scenery, continually changing—Great difficulties met with, requiring a wide change of route—Success almost despaired of—Effect of depression on our progress—Bridge of ice—Treacherous Snow—Ice-rafters of unseen cavities—Observers in the valley—Grand Plateau—Incipient loss of appetite—Dark colour of the sky in part, at least, *subjective*—Rochers Rouges—Fatal Avalanche in 1820—Saussure's route from the Grand Plateau—New route—Sensations—Heat oppressive—Veil—Green spectacles—Insects—Alpine crows—Danger at the Epaule droite—Feet nearly frozen—Giddiness—The height of 14,700 feet attained.

ERRATA.

Page 23—Line 8 from bottom, *for* Michal *read* Michel
— 36—Line 7 from top, *for* 09 *read* 90
— 38—Line 10 from top, *for* Devouassou) ; *read* Devouassoud) ;
— 82—Line 12 from top, *for* Matezesecki..... *read* Malczewski.

FIRST LECTURE.

The summer of 1834, spent at Heidelberg in Baden, was one of the hottest known in the south of Germany to any living. That delicious spot seemed to have Italy's climate, in addition to its own peculiar scenes. Steamboats were stranded, in some parts ceased to ply, upon the then shallow Rhine. But in proportion as the waters of that river fell, the vines upon its banks smiled, and there has rarely been so rich a vintage.

Set, gem-like, among steep mountains, wooded to their very tops, Heidelberg claims the passing tribute of a line, from one who can still in memory contemplate its ruined battlements, and terraces, and prostrate towers, the

windings of its "Neckar," and its groves of nightingales, as well at early dawn, as by glowing sunsets, or when the moon "lends her enchantment" to the silver scene.

The autumn, after one great storm, that rendered impassable the Simplon and other roads, was a long-continued season of the finest weather. It was spent in rambling, much on foot, through Switzerland. An object of natural history had taken me annually, the preceding four years, among the mountains and the glens of Scotland. I knew well her "northern battlement of hills," had seen perhaps the wildest of her Grampian wilds, and now saw them on a larger scale. But there were added, the snow-crowned summits of the Alps, the exceeding richness of their vallies, and Swiss cultivation "far up the mountains' side."

This is not the place to say much of the mountains, now properly called Swiss. One of these, however, repaying more, I think, than any other, the labour of an ascent, is but little known. It is the Faulhorn, a peak of the Oberland of Berne; having, not far off, the Finster-aar and Wetterhorns, the Schreck-

horn, the Jungfrau with her silver horn, the Mönch, the Eiger, and a host of other pyramids of snow." On its summit there is now a hospice,—the highest European habitation,—tenanted every summer. The view, even from the Rigi, is not so splendid, because of the remoteness of that mountain from the Alps of Berne.

I have stood upon the high altar of the Faulhorn. There, at earliest dawn, with the still loftier summits of the other Bernese Alps, mailed with ice, in line immediately before me, watched,—until the highest peak of all caught the sun's rays, and shone in the twilight as a point of gold; this standing for a while alone; and then another, and another mountain-top was gilded, until there was a chain of brightness; then a wall, with pyramids, of rosy light; lastly, the great source of light rose, beaming the refulgence of the morning. From that mountain-top I have beheld, too, a sunset scene, similar in beauty, but reversed; the glaciers' roseate tint yielding to a purple hue, and this gradually lost in the evening twilight.

The autumn continuing one of almost cloudless skies, there was permitted a free range

through the wildest of the Helvetian fastnesses; and many a living picture of Swiss alpine splendour is now in memory before me. Yet there remained, beyond the Savoyan barrier, scenes still more inaccessibly sublime.

A route, as it happened, had been taken, not affording, from any point, a view of even the summit of Mont Blanc. The 15th of September brought me to the Col de Balme (9) *, a mountain bounding the north-east end of the vale of Chamonix; and on the top of which, leaving the Canton of Valais, you enter the kingdom of Sardinia, and the Duchy of Savoy.

The ascent from Martigny, in the valley of the Rhone, was very steep. Nothing was seen, advancing towards the top, besides the rocks that formed it. When, suddenly upheaved itself a scene of alpine magnificence, long unapproachable and overwhelming; an amazing picture, which the eye knew not how to scan, chaining the beholder, lost in an astonished gaze. The prodigies of nature piled up there, cast other, even alpine splendour, far into the shade.

* See the large Plate appended.

A thousand towering, dark, and savage peaks,—lightning-riven battlements,—at whose bases, hardened and heaped up, great depths of ice, bidding defiance to the sunbeams; and glaciers, winding many a league downwards, through their own ravines, like belts of brightness, "flung over a region" black with pines.

Beneath that heaven-high wall of frowning rock and chilling ice, bordering upon the barrier of permanent congelation, and like an oasis within a wilderness of frost, was the green vale of Chamonix, smiling with rural beauty and the abodes of man: the river Arve (49) rising at my feet, and winding its way in silver through the meadows of that vale.

But, for those scenes of softer beauty, the eye was paralyzed,—it saw them not, save in so far as they made, by contrast, the icy regions towering above them, more arctic, chill, and awfully sublime. To these, the eye, spell-bound, ever returned; and yet the one great sorcerer of the mighty scene remains unnamed.

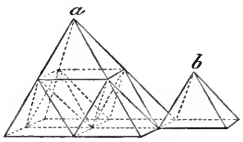
Surrounded by those "ragged heights of rocks," those battlements, towering nine thousand feet, and more, above the valley,—so

vertical, that snow rests not upon their sides, —there rose, far higher than them all, a snowy pyramid, in proud supremacy, yet placid and serene (56). It was "the father of the Alps," Mont Blanc himself, enthroned among, and guarded by, his dark aiguilles.

A letter of the German poet Goethe, describing an evening approach to the vale of Chamonix from Geneva, contains a passage, which I cannot help translating. He says, "It became darker,.....only the greater masses were visible. The stars, one after another, rose; and we observed, over the summits of the mountains, a light, which we could not understand. Clear, without lustre, like the Milky Way, yet denser, —almost like the Pleiades, but greater,—it long had our attention, until at last, as we changed our position, like a pyramid, pervaded by an inward mysterious light,—most resembling the brightness of a glow-worm,—it projected over the tops of all the mountains, and made us certain that it was the summit of Mont Blanc (56). The beauty of this sight was most extraordinary; for as it shone with the stars that stood around it,—not indeed in equally vehe-

ment light, yet in a broader, more connected mass,—it appeared, to the eye, to belong to a higher sphere, and it required an effort to conceive its base fixed to the earth."

The snow-line of the Alps in the high latitude of about 46° N. is only 8,300 feet above the level of the sea; that of Chimborazo, the highest of the Andes, 15,700; and that of the Himmalayan Mountains, in latitude about 32° N., 17,000. Hence, though Mont Blanc is not equal in elevation, its covering of permanent snow occupies a cone, nearly one half higher than that of Chimborazo, and scarcely inferior to that of the highest peak of the Asiatic range.



The snow-cap, *a*, of Mont Blanc is twice the height of Benlomond, *b*; and having twice the height, its base may be considered as having four times the area; hence the snow-cap of Mont Blanc would contain eight of Benlomond ($4 \times 2 = 8$). Taking the *whole* of Mont Blanc, its height above the level of the sea is $= 4\frac{1}{2}$ times that of Benlomond; the base of the former has, therefore, an area $= 20\frac{1}{4}$ times that of the base of the lat-

ter, and the solid content of Mont Blanc is thus more than 90 (= $91\frac{1}{8}$) times that of Benlomond.

And if Mont Blanc be considered,—not as regards its height above the level of the sea, but, as rising directly from the vale of Chamonix, we find it the most considerable mountain known; for its summit is 12,300 feet above that valley,—Chimborazo not more than 11,600 above Tapia,—and the loftiest Himmalayan peak, only 10,800 above the level of the lowest plain of Thibet.

The vale of Chamonix seems to have been quite unknown to tourists, until within ninety-five years of the present time. "It was in 1741," says Ebel, "that the celebrated traveller Pocock, and another Englishman named Wyndham, visited it, and gave to Europe, and to the whole world, the first notions of a country, which is situated at the distance of only eighteen leagues from Geneva. As every body thought that this valley was a den of banditti, and of barbarous and savage people, the resolution of these gentlemen to visit it was blamed; they were so seriously counselled to be upon their guard, that they set off from Gene-

va, armed to the very teeth, with a number of servants no less armed; they did not venture to enter any house in the valley, but encamped under tents, and kept up fires, and a watch by sentinels, the whole night. The mountains of the neighbourhood were then known under the name of *Montagnes Maudites* or Cursed Mountains." Such is the account given by Dr Ebel,* of the discovery of Chamonix, in 1741.

Captain Sherwill,† however, has satisfactorily shewn, that a convent of Benedictine monks having been founded at Chamonix, by Count Aymon of Geneva, about the year 1090, other persons settled there; that the bishops of Geneva, as well as others, repeatedly visited the valley; and that it was known, and had communication with the neighbouring towns, during six hundred and fifty years previous to the visit of Pocock and Wyndham, in 1741: yet he adds his conviction, that the valley would have remained comparatively unknown to travellers, had not the "indefatigable zeal and manly pru-

* "Manuel du Voyageur en Suisse, traduit de l'Allemand."

† "Historical Sketch of the Valley of Chamouni."

dence" of these English gentlemen, urged them on to examine the hidden beauties of this then neglected corner of the world.

Captain Sherwill considers, that the origin of the name "Chamouni" may be found in two words, occurring in the Latin deed of gift by Count Aymon to the Convent: these are, "*campus munitus*," i. e., *fortified field*; the lofty mountains and inaccessible aiguilles, that surround the valley on all sides, being, no doubt, the natural defence or fortification here implied: "but, to arrive at the literal word 'Chamouni,' we must translate them into French, or into the *patois* of the country, and the signification is equally good in both; for instance—'*campus*,' *champ*, and '*munitus*,' *muni*. The term 'Prieuré,' was generally used until the year 1330; when the few cottages, that surrounded the monastic building, assumed the name of Chamouni."

But, returning to my own station on the Col de Balme (9), the summit was not wrapped in vapour,—the sky was most serene. Not unfrequently may that spot be visited, with a view of the base alone; how often, seeing not more than the shoulder of the mountain; how

still more often, while other, even lofty mountain-tops are visible, that snow-haired "monarch of the Alps" alone, is canopied in clouds.

This is not the time to discuss the question, whether my object in attempting to ascend the mountain was, or was not, commensurate with all the risk and all the danger: it will be sufficient now to say, that the idea of an ascent, conceived but a few hours before, became at the Col de Balme a settled purpose.

"Und wohnt er droben auf dem Eispallast
Des Schreckhorns, oder höher, wo die Jungfrau
Seit Ewigkeit verschleiert sitzt—Ich mache
Mir Bahn zu ihm."*

While I was on the Col, there came up a party from the valley, attended by a guide of Chamonix. The latter had ascended Mont Blanc once, but said he would never go again, and tried to dissuade me from making the attempt.

On my arrival at the Priory of Chamonix (48) that evening, guides were consulted, as to the probable practicability of an ascent. It was objected, in the first place, that the season was too far advanced, and secondly, that some snow

* Schiller.

had recently fallen, which had not had time to harden: as a consequence of the first obstacle, that the days were too short, and that the fissures had probably widened; of the second, that the way would be rendered not only more difficult, but more dangerous also, from the newly-fallen snow lightly covering, and thus concealing, the smaller crevices. Avalanches, too, were likely to occur more frequently, with a layer of recent snow. On the other hand, the weather had never, perhaps, presented a more favourable opportunity; the moon was nearly full; I was in excellent "training," from having lately climbed some of the heights in Switzerland; and additional interest was given to the undertaking, from the lapse of four years since the last ascent; which, according to a list seen at the Priory, was made by a fellow-countryman, Captain E. B. Wilbraham, in 1830.*

Taking all circumstances into consideration, I resolved to make the attempt, and having, not without some hesitation on their parts, engaged six guides, I set out the next morning,

* I was informed that an attempt had been made this summer, (1834) by two gentlemen of Savoy; but that, from bad weather, it had failed.

September the 16th, at half-past eight o'clock. A rumour of the enterprise had become general in the village, and, in consequence, there was a group of persons near the Hotel de l'Union*, to witness our departure. The cottagers too, as we passed through the valley (78), gave us their best wishes; here and there, an anxious face, bespeaking relationship with some of the guides.

We left the valley at the village of les Pélérins (51), and, ascending through the pine forest eastward of the glacier des Bossons (62), reached successively the Chalet de la Para (the last human habitation), Pierre Pointue, and Pierre à l'Echelle: the latter point by noon.

The highest tree is Pinus Cembra, the Siberian pine, found in sheltered situations, on that the north side of the mountain, more than 6000 feet above the sea. There were acres of Rhododendron ferrugineum, the beautiful Alp-

* I am much indebted to the proprietors of this excellent hotel, Charlet and Simond, for their assiduity in providing such an outfit as should ensure me as much comfort as possible in the expedition; for their attention during my subsequent stay at Chamonix; and for the promptness with which they furnished information, for which I afterwards applied to them by letter.

rose, just gone out of flower, and of many other alpine plants,—though the season was so far advanced,—zone could be observed succeeding zone, in the order of their hardihood, on the primitive debris of the "Moraines." Here and there a prostrate trunk of pine, cast down by avalanches, afforded us a little wood for fuel, and was collected by the guides.

At Pierre à l'Echelle we overtook some men employed by the guides to carry thus far part of the baggage, consisting of charcoal, extra clothing, blankets, ropes twelve or fourteen feet long, for the purpose of tying us together when passing over a dangerous surface, a vessel in which to boil water, besides a mountain barometer, two thermometers, a telescope, and what was perhaps of more importance than any one thing besides, an axe to cut our way up and down the ice-masses and indurated snow. These men, the bearers thus far of the baggage, returned to the valley.

Several Chamois were seen bounding fleetly over the rocks just above us. We had surprised them in a situation from which even these animals could not easily extricate them-

selves; and two or three minutes elapsed before the last of them made its escape, which it effected by crossing the glacier.

At Pierre à l'Echelle we made a second breakfast, and, at the foot of the Aiguille du Midi (37), entered upon the ice, *over which exclusively our course now lay*, in perpendicular altitude, 7000 feet. Bifid iron points (they should have been of steel) were screwed into the soles of my shoes, to prevent slipping. A boy despatched from the village of les Pélérins (51) to the Priory (48), for some spirit of wine, wanted for an experiment on the summit, now came breathless after us. I was greatly disappointed, however, to find that it was not alcohol, but *nitric acid*, that he had brought.

Crossing obliquely the glacier des Bossons, we ascended south-west to the Mulet rocks (61), on one of which we hoped to pass the night. Each of the party carried a bâton or pole, six or seven feet long, armed at the end with an iron spike.* This was to serve as a support and balance to the body, when climbing up the slippery ice, or to afford a cross-

* Better, made of steel.

ing beam to narrow crevices, into which we might begin to fall.

The glaciers are sloping fields of ice, that occupy ravines in the sides of mountains; moving slowly and imperceptibly, but continually downwards, it is said at the rate of a foot each day. Where in contact with the warmer surface of the ground on which they rest, and at their sides, they thaw; and being thus loosened, way is made for their descent. But here and there some obstacle occurs, that holds them, until their weight overcomes and carries downwards the obstruction; or, when the latter does not yield, the glacier becomes transversely rent, by which the lower portion of the mass is separated, and proceeds; the fissure widening, until filled up by the ice-debris of avalanches, or the next winter's snow. The obstacles consist, for the most part, of rocks, projecting from the sides of the ravines. A little water from the surface of the glacier, finds its way in the day-time into the crevices of these rocks, and in the night irresistibly expanding into ice, loosens them, so that they must eventually yield. Glaciers thus widen

their ravines, by taking from their sides. Hence the vast lateral accumulations of debris, and the uprooted branchless pines. The former, at the sides of the Bossons glacier, are called "The Moraines." The surfaces of glaciers present, besides, great and general inequalities, which, using a geological expression, may be called slips, with vast overhanging mural precipices, referrible to corresponding inequalities in the beds of their ravines.

The glaciers of Bossons and Taconnaz, rent in some parts almost from side to side, are the great receptacles of ice, falling from the north side of the summit of Mont Blanc, with which in unconnected portions they are strewn. Enormous masses becoming lodged, half in, half out of the rents, form sometimes the only bridges by which the latter can be crossed. Steps are hewn with the axe, up one side and down the other, of these blocks of ice. Sometimes the bridge consists of a heap of smaller masses; sometimes there is no bridge at all, and you have either to pass along the margin of the chasm, until a narrower part of it is reached, where you may spring across (this,

however, at the risk of not getting back, on the other side, to the line of route you were pursuing), or, held by a rope, you descend into the fissure to some shelving ridge, from which you gain, and cut your way up, the precipice on the other side.*

* Dr Clarke, who ascended Mont Blanc in 1825, has well described the crossing of a fissure in the last mentioned way:

"The chasm, though wide above, was not very wide beneath. The sides sloped down to a kind of serpentine chink from three to four feet wide, but of unknown depth. Our guide Julien, a thoroughly brave steady man, descended first to the end of the chink, cutting holes as he descended. When at the brink it was still too wide to jump across, especially as the landing place on the other side was steep and slippery, Julien called to us above to hand down our ice-poles; accordingly, four or five poles were handed down to him. These poles he placed from brink to brink, so as to make a little bridge, and then, after cautiously trying its strength, he slowly and steadily walked over to the opposite side. I must honestly confess that I did not at all admire this very ingenious contrivance, and did not much care to look on while Julien performed the feat. But the difficulty was not then at an end, for he had afterwards to climb up a high bank of snow so exceedingly steep that he could only ascend by cutting alternate holes for his feet and hands with the axe. This was a very singular and awkward affair; we stood watching him in breathless anxiety, expecting every moment that he would slip backward into the chasm. For his sake and our own we were heartily glad to see Julien safely emerge and fairly landed on the plane of snow above. He then let down his rope to assist and steady us in crossing the bridge of poles, and afterwards to help us in mounting the snow-bank. I am rather inclined to think that this passage was the most hazardous of the whole expedition; nor do I know whether the

And if, as was the case when I was there, snow have lately fallen, the narrow, incipient crevices become concealed, and the small openings between the accumulated masses,—some so small that not more is threatened than a broken leg, others large enough, however, to engorge a human body,—these are lightly filled up; and if you step on the thin crust concealing them, it lets you through.

Sometimes, too, a loose mass, on which for a moment you have rested, slips,—and, taken unawares, your other foot slips,—and, not adjusted, the bâton slips,—and there is no point for the hands to grasp, if, indeed, the hands are not too benumbed to grasp at all. You vainly strive to cling with arms and knees to the moving ice; perhaps, too, on one of those uncertain bridges,—and see on both sides a

danger was greater of slipping off the tottering bridge into the chasm, or of falling backwards in climbing up the frozen bank of hard snow, where we had now and then to cling to the holes in the ice till our fingers ached with the grasp. Yet the aid afforded by these brave mountaineers is so prompt and so efficient, that the danger is by no means so great to the traveller as it would seem to be. To the guides, and to the guides only, belongs the merit either of courage or of dexterity in the matter." —*Dr Clarke's Narrative.*

yawning rift, having, indeed, bright walls, but —dark, tremendous depth. At such an awful moment, the guide, ever watchful, turns, and with the greatest coolness, and strength that seems Herculean, draws you up to the firmer, though still, perhaps, precarious point on which he is standing: and you feel that he has saved you. This is not an exaggerated picture.

It is wonderful to see those Savoyards,—strong in Alpine hardihood, and used from early life to clamber after chamois,—springing sure-footed from mass to mass, and walking on slippery and narrow ridges, seeming quite regardless of the gulf, into which one false step would cast them. A guide immediately precedes, and takes especial charge of you; and you have to watch and closely follow, if you can, his every step,—placing your foot only on such parts as his has tried.

No sound is heard in those solitudes, save the deep and hollow murmur of an unseen torrent, whose path lies 300 feet * and more down

* The ascertained thickness of the ice in some parts of the Mer de Glace (30), is 300 feet. It is probably 500 in some parts of the Glacier des Bossons (62).

the clefts. It is the genial warmth of nature, working in the depths of the dark ice-chambers, where the last stratum of the glacier lies in contact with the ground. Many such torrents joining, form a river, pouring perpetually from the foot of every glacier.

The ice assumes the most fantastic forms, exhibiting a curious scene, days' journeys wide, of wildness untameable and sparkling azure. The Mer de Glace (30) has been said to exhibit an appearance, "as if frost had suddenly bound up the waves and whirlpools of a mighty torrent." The Bossons glacier (62), I would say, resembles more a city, converted into ice,—then shaken into ruins; and taking a Dutch city, the chasms are represented by canals. But the surface of the Mer de Glace, even as high up as the Jardin, presents no ice masses, and no chasms, to be compared in magnitude with those occurring on the upper part of the Glacier des Bossons, which we crossed the first day; and yet there awaited me higher up the mountain, icy scenes of still more dazzling splendour, and on a mightier scale.

The guides had said, that from the lateness

of the season, the fissures would be found much widened; and so it proved. To this an unusually hot summer also, had doubtless tended. These fissures gave a most zigzag direction to our course, compelled us to retrace painfully-taken steps, and sometimes to reascend walls, where ropes as well as hands and knees had been employed to enable us to scramble down.

It was the lower and larger of the mulet rocks, the Grand Mulet (61), that we were to try to gain, as our quarters for the night. But the most eligible point from which to climb up the rock, was absolutely unattainable; a great fissure, and a mural precipice beyond it, intervening. We therefore retraced our steps down towards the base of the rock. But here, too, a wall of solid ice was interposed.

The guides threw down their provision-bags, and set earnestly to work. I took, as well as benumbed hands permitted, a sketch or two the while, from which the two small plates are taken.* The leading guide, secured with

* The plates present but a small portion of the rock *near its base.*

a rope, was lowered down to a projecting point, on which there was a footing for his toes. He then clambered up from point to point, also cutting steps, until at last, with labour exceeded only by the peril of his situation, he attained the rock; other guides continuing all the while their hold of the rope with which he had been tied, as a false step would otherwise have cast him down into a chasm, the depth of which we could not ascertain. Another guide was now secured, and the rope thrown up to him already on the rock; so that the former also gained it. These two then drew up the others of the party, as well as the provision-bags, by means of ropes.

The first guide who reached the rock, was our captain, Joseph Marie Couttet; the second, Michal Balmat. Of these intrepid men I cannot say enough, to do justice either to them or to my own feelings. Without them, the undertaking must have failed, at the base of that rock, or elsewhere. The well-known Couttet had reached the summit of Mont Blanc eight times before. On one occasion, both his legs were fractured by falling rocks. On another,

one of his hands was greatly injured. In the attempt of Dr Hamel, an avalanche swept him away, and hurled him down a chasm with four other guides, three of whom perished. No one should attempt to ascend Mont Blanc without him. His intelligence is extraordinary.* The comprehensive view taken by him and Balmat, in planning, on the height of some ice-tower, a winding route across the glacier, is wonderful. When these two guides were not obliged to take the lead, I was glad to have them near me; but on all occasions requiring much coolness, intrepidity, experience, and judgment, they were the leaders of the party. Couttet and Balmat are particularly mentioned, not for their own sakes merely, but because I may thus serve some future traveller. The other four were Pierre Tairraz, already three times up the mountain; François Despland, and Simon Tournier, each up once before; and Jean Tairraz, going up for the first time. I can recommend them all: each in his turn assisted me in difficult and dangerous places, and per-

* Couttet has a good collection of crystals and mountain rocks for sale, at the Priory of Chamonix.

formed his part in a faithful manner. The one last named, Jean Tairraz, is a young and very enterprising guide. His attentions added not a little to my comfort, during our stay upon the rock.

Never had Couttet found it so difficult to attain the Grand Mulet rock. He afterwards handed me a memorandum, from which the following is taken. "Je soussigne et certifie avoir été 9 fois au sommet du Mont Blanc. Je n'ai jamais rencontré autant de difficultés que cette fois-ci (avec le Docteur Barry, que j'ai accompagné jusqu' au sommet du Mont Blanc) pour arriver au Grand Mulet (61): et la neige nouvelle nous a beaucoup fatigué. Malgré toutes les difficultés, notre voyage a été heureux.—*Chamonix, le* 20 *Septembre* 1834.

(Signed) COUTTET JOSEPH, Guide."

The part of the rock first gained, was at no great height above its base. Hence we had to scramble up two hundred feet of the nearly vertical micaceous strata of this aiguille; portions of which, disjointed, now and then slipped, threatening destruction, not more to him

standing on, or clinging to them, than to those below, upon whose heads they narrowly escaped falling. Well do I remember the vigilance and prodigious strength of Despland, the faithful fellow who had me then in charge; which, indeed, I thought it worth while to notice in the certificate afterwards given to him.

There is a ledge of a few square feet, a sort of open shelf, on the south-west side, and several yards below the top, of the rock; the margin, a precipice of seventy or eighty feet. Upon this shelf, as a spot not reached by avalanches, we were to pass the night.

It was half-past six o'clock. I have spoken of a sunset from the Faulhorn: now higher by two thousand feet,—myself a point upon the glacier-wall of rosy light,—I drank the radiance of another; witnessed the parting tribute of the sun to lake Leman,—which, though distant about fifty miles, shared it with me; saw him go cloudless down behind the Jura,—leaving us to enjoy upon our rock, in the purple of the evening, the serene assurance of his bright return.

The height of the Barometer was = Eng.

inches 21.235; the attached Thermometer = 45° 50 F.

Our bâtons, inclined against the rock, served as the rafters of a little cabin : over these two sheets were thrown, as roof and walls; blankets being spread upon the floor of rock. A fire was kindled near the tent, and, with good appetites, we supped around it. Thirst had become very great.

At nine o'clock, adding three-fold to our clothing, and wrapping up especially the feet, we crawled into our cabin, and stowed ourselves transversely on the ledge, in a half-sitting posture, with our feet turned towards the precipice; a provision-bag serving as my pillow. The guides lay very close beside me, and thus the night was not found cold.

The guides soon slept soundly; but excitement kept me wide awake, and I lay listening to the long-reverberated sound of avalanches. That was a season truly for reflection. Some of that falling ice covered, perhaps, the track that we had made to-day; how possible that other masses might meet us in our path to-morrow. What should I do, if any of my poor guides

were swept beyond recovery into a chasm, or suddenly to disappear, sinking into hollows, through thin crusts of snow? Their families in the vale,—what were then their feelings; and what those of one,—the best of brothers,—whom I had left there; whose parting look had vividly remained before me all the day.

I cannot say that I felt at that time the least fatigue; an exemption attributable to the magnitude of the undertaking, and to its being, as it were, only begun. At length, however, I too slept, but not soundly, and I lay wide awake again at twelve. I got up, and found to my sorrow, that Couttet and the younger Tairraz were lying in the open air, the cabin being too small to hold more than five. But the cold was not severe, for a thermometer at nine o'clock, indicating 39° F., had risen to 42°, a smart breeze from the south-west having subsided. At half-past one, the thermometer had again fallen to 41°.

It was a brilliant night. Beneath a dark and cloudless vault, the snowy mantle of the mountain shone resplendent with the beams of a full, Italian moon. The guides lay buried in

the deepest sleep. Thus, in the midnight hour, at the height of ten thousand feet, I stood—alone: my resting-place a pinnacle of rock, that towered darkly above the frozen wilderness, from which it, isolated, rose. Below me, the yawning rifts and uproarious desolation of the glacier, presented an appalling picture of dangers, scarcely gone by; around and above, was a sea of fair but treacherous snow, whose hidden perils yet lay before us. I saw the chain of Jura, and the distant top of many an unknown alp,—an earnest of the prospect from still more lofty regions; yet among them, Mont Buet's white dome,—a warning monument of Eschen's fate,—forbade the attempt to go up higher. The vale of Chamonix slept at the mountain's foot; and, now and then broken by the deep thunder of an avalanche, the profoundest silence reigned. It seemed the vastest, wildest, sternest of Nature's prodigies reposing;—now starting, as in a fitful dream, —then sinking again into the stillest calm. The influence upon my mind of that poetic "vision of the night," I must despair of ever being able to communicate to others: and yet

the scene itself lives, "a picture in my memory," standing alone,—unalterable by time. It held me, until an hour and half had passed away; when, a recollection of the coming day's fatigues, rendered it proper, again to try, at least, to take repose.

In three hours, the guides roused me: of course then, from my vigils, little disposed to rise. It was past four o'clock. Orion shone where the full, and now setting, moon had beamed three hours before. Soon the mountain-top became a pyramid of gold; delightful token that the rising sun,—between which and us, the mountain intervened,—had redeemed the pledge given by his departing rays.

First, lightly breakfasting, we left the rock at five. Proceeding then across an ice-valley, we approached the base of the Dôme du Goûté (57); then ascended zig-zag towards the Plateaus.

The recent snow, nearly knee-deep, made the way laborious; the safety of each step was tried before taken, by our leader, with the bâton; we proceeded in a line,—held, in twos and threes, with ropes,—and following carefully and

very exactly the same footsteps, as less wearisome than new plunges in the snow, and for the more important reason, that they were the only tried portions of the faithless surface.

Our course lay, for the most part, over vast fields of snow ; but the early portion of it presented scenery of surpassing beauty, far more magnificent and dazzling than that of the day before. There were broad and bridgeless chasms, whose depths the eye, from their dizzy edges, vainly sought to ascertain ;—towering masses, in forms that, from their strangeness, seemed unreal ;—spires of brightness, grottos and palaces of frost,—here recent, soft, of snowy whiteness,—there older, hardened, passing into crystal azure,—sprinkled with frozen dew, festooned with silver fringe ; their inmost caverns dark, —vast stalactites of ice, in line, guarding the portals. " These fairy structures," as said by Clissold,* " successively dissolving in the warmer atmosphere of the afternoon, and being hardened again by the nightly frosts, are perpetually starting into new objects of won-

* Narrative of an Ascent to the Summit of Mont Blanc, August 18: 1822.

der." Such scenes are in recollection vivid,—I see them now,—but words are wanting, to impart them to another. No wonder if I often turned, and turned again, not knowing how to leave them (I).*

Feelings, however, very different, soon succeeded. All the experience and intrepidity of Couttet and of Balmat were called forth, to contend with difficulties that occurred on every hand. We reached, indeed, one point, where it was found impossible to advance further in the same course; and from a tower of ice, obstacles were discovered, requiring a wide change of route. The two exploring guides went a long distance towards the Dôme du Goûté (57), in search of a new passage; the others and myself, knee-deep in snow, anxiously awaiting a signal to follow, or their return: but they were foiled. Another, and yet another course was sought, in vain.

Four years had elapsed since Mont Blanc was last ascended; hence we knew not but that, from the shifting nature of the snow-masses, changes had occurred, that might en-

* See the notes appended.

tirely cut off our further progress. Auldjo* had said indeed, from alterations which he thought he saw taking place in the glacier in 1827, that probably the summit would soon become inaccessible. The half French, half Italian *patois* of the guides,—scarcely understood by me, when, under ordinary circumstances, they conversed among themselves,—was now sufficiently intelligible, from vehement outcries of disappointment. Their faces too, convinced me that success was not far from being despaired of.

Yet another course was tried; a long, steep, and most round-about ascent, affording the last forlorn hope. The day before, I had ascended to nearly twice the height of the highest of the Scottish Grampians, with less than half the fatigue that it had, on two occasions, cost me, to reach the top of Ben MacDhui;—and why? because the magnitude of the undertaking lent me energy and strength,—and so long as obstacles could, by any means, be overcome, toil was unknown. But now, dispirited, how great

* "Narrative of an Ascent to the Summit of Mont Blanc, 8th and 9th August 1827."

was found the labour of the way; how painful and how slow our zig-gag course.

This long and weary ascent being at length accomplished,—could we proceed? No!—an enormous fissure now presented, to cross which was impossible: and here we must have turned, but for a bridge of ice, discovered at a distance. We made for that bridge,—it bore us over.

Now, there were seen no chasms nor ice-masses, to obstruct our progress, and my hopes brightened, the prospect seeming fair. The most experienced guides perhaps thought otherwise, and truly otherwise it proved. We walked upon a surface made resplendent by the moon the night before; but not less treacherous than fair. Our leader paused, and warned us of a hole, covered with recent snow, into which his staff had sunk. Again he stopped, meeting with another,—and another. This occurred so often, that openings must have surrounded us on every hand. Thus we were walking on the ice-rafters of unseen cavities. Lower down, upon the glacier, we saw dangers, and could sometimes avoid them; now, they were

hidden, with an awful certainty of their existence; and in a moment, the precarious crust on which we knew ourselves to stand, might, to a large extent, have given way.

How cheering, at that time, the announcement by a guide, "*On nous regarde.*" He knew that we had just then reached a point, from which observers in the valley could, with the telescope, discern us in our snowy track; and I well knew that among those observers, there was one, spoken of before, whose anxiety, left as he was, in ignorance of my fate, had marred with me the pleasures of the enterprise. It was a source of great joy to feel assured that, by that time, his mind had been relieved; and the unseen cavities below me were forgotten.

We soon afterwards arrived upon the Grand Plateau (60), another great stage of the ascent being thus accomplished. Now, the prospect being really fair, we felt more confidence, and sat down upon the snow, in good cheer, to breakfast; though there was felt, even at that height, incipient loss of appetite.*

* "Dr Clarke and Capt. Sherwill, with their guides, felt much more, this want of appetite upon the Grand Plateau. Dr Clarke says, 'It was laughable enough to see the same men who, a

Besides the Grand Plateau (60), two other plains of snow, crossed lower down the mountain, have been called "plateaux." It was on the middle one that Saussure, with eighteen guides, passed the second night in his ascent in 1787. Speaking of it, he says, "It is 09 toises (= 575 English feet) higher than the Peak of Teneriffe.

While resting here, the blackish-blue, or rather purple-black, colour of the sky arrested my attention. The colour of the sky, from understood causes, is known to vary with the observer's elevation, with latitude, the sun's height, the season of the year, &c., it is paler above the ocean than over land; and, of course, is deepest in the zenith. But above the snow-line, the eye contemporaneously receives white rays from vast walls of snow; and thus, by contrast, the sky seems darker than it really is. Convinced that such must be the case, I lay down upon my back, and shut out the snow from view, by a cylinder formed with both hands, —closed my eyes for some moments, then

few hours before, would have eaten a fraction of a roasted buffalo, now hanging their heads in silence, and fastidiously picking a pullet's wing."

opened them upon the zenith,—and found the tinge of black more or less completely gone. Thus, viewed without and with the cylinder, a tint rather less red, and blacker, than Werner's "Panzy purple," was made to alternate with a dark "China blue." (H.)

By 10 o'clock, we had left the Grand Plateau (60). Above the latter are the Rochers rouges (59), where the fatal avalanche occurred in the attempt of Dr Hamel. The following narrative of that melancholy scene is given by Dr Clarke.

"We had now not quite a mile to proceed, before arriving at the spot where the sad catastrophe occurred in 1820. This circumstance threw an air of seriousness into all faces. Our captain, Couttet, and brave Julien, had both most narrowly escaped death; nor could they approach the grave of their unhappy comrades without emotion. Julien gave a very clear and minute account of this disaster, which I wrote down immediately from his lips. The party had breakfasted on the Grand Plateau, near the spot at which we halted. They then traversed the plain, and began to ascend the highest

steeps of the mountain, called among the guides La Calotte de Mont Blanc.* In proceeding obliquely upward, they approached a dark rock, which we saw above us deeply imbedded in the snow (59). 'The order of march,' said Julien, 'was this:—at the moment of the disaster, the leading guide was Pierre Cairriez; 2d, Pierre Balmat; 3d, Auguste Tairraz: (these three perished); then, 4th, moi (Julien Devouassou); then, next to me, Marie Couttet (our captain); then, behind, were five other guides, with Dr Hamel (a Russian physician), and two English gentlemen. Suddenly, said he, I heard a sort of rushing sound, not very loud; but I had no time to think about it; for, as I heard the sound, at the same instant the avalanche was upon us. I felt my feet slide from beneath me, and saw the three first men fallen upon the snow with their feet foremost. In falling, I cried out loudly, 'Nous sommes tous perdus!' I tried to support myself by planting the ice-pole below me, but in vain. The weight of snow forced me

* "The close black silk-cap, worn on the crown of the head by the priests, is called the Calotte. Whenever the original French is given, it is exactly as spoken by the guides, without any emendation."

over the bâton, and it slipped out of my hand. I rolled down like a ball, in the mass of loose snow. At the foot of the slope was a yawning chasm, to the edge of which I was rapidly descending. Three times I saw the light, as I was rolling down the slope; and, when we were all on the very edge of the chasm, I saw the leg of one of my comrades, just as he pitched down into the crevice. I think it must have been poor Auguste, for it looked black, and I remember that Auguste had on black gaiters. This was the last I saw of my three companions, who fell headlong into the gulf, and were never seen or heard again.

"At this moment I was just falling into the same crevice, and can but confusedly understand why I did not: but I think I owe my life to a very singular circumstance. Dr Hamel had given me a barometer to carry; this was fastened round my waist by a strong girdle. I fancy that at the moment this long barometer got beneath and across me; for the girdle suddenly broke, and I made a sort of bound as I fell; and so, instead of following my poor comrades, I was pushed over into another crevice,

close to that in which they were killed. This chasm was already partly filled with snow: I do not think I fell more than fifty feet down, alighting on a soft cushion of snow, and a good deal covered with it above. I suppose before tumbling into the chasm, we slid down from one hundred and fifty to two hundred feet; but I cannot tell, for it seemed to me not more than a minute from the time I heard the noise of the avalanche above me, till I found myself lying deep down in a narrow crack.' All estimate of distances in such circumstances must, of course, be rude guesses. Couttet's reply to the same question was this: 'I should fancy I slid down near four hundred feet, and tumbled headlong about sixty feet.' I asked Julien what his thoughts were during this awkward tumble. His reply was in these words: 'Pendant que j'ai roulé j'ai dit à moi-même, 'Je suis perdu, adieu ma femme, et mes enfans!' et j'ai demandé pardon à Dieu. Je n'ai rien pensé absolument des autres.

"'On coming to myself,' continued honest Julien, 'I was better off than I had expected. I was lying on my back, heels upwards, with

my head resting against the icy walls of the crack, and I could see some light and a little of the blue sky through two openings over my head. I was greatly afraid that some of my limbs had been broken, but I had sunk into the mass of soft snow, and though bruised by falling against the sides of the ice, yet nothing was broken, and in a few moments I contrived to get up on my feet. On looking up, I saw a little above me a man's head projecting from the snow. It was Marie Couttet (our captain): he was quite covered with snow up to the neck, his arms pinioned down, and his face quite blue, as if he was nearly suffocated. He called to me in a low voice to come and help him. I found a pole in the crevice (I think not one that had belonged to the three who perished, but another): I went to Couttet, dug round him with the bâton, and in a few minutes I got Couttet clear of the snow, and we sat down together. We remained in silence, looking at each other for a minute or two, thinking that all the rest were killed. Then I began to crawl up on the snow that partly filled the crack;

and, in climbing up, I saw above me David Couttet, who was crying, and saying, 'Mon pauvre frère est perdu!' I said, 'Non! Il est ici en bas.' (Couttet was climbing behind Julien, and so not seen at first). Et moi j'ai dit, 'Les autres sont ils tous là en haut?' Ils ont dit qu'il manquoit encore trois. Et j'ai demandé, 'Qui sont ils qui manquent?' Ils ont dit, 'Pierre Cairriez; Pierre Balmat; et Auguste Tairraz.' Nous avons demandé si les messieurs avoient du mal. Ils ont dit que non. Then the guides helped us to get up about fourteen feet on the solid ice. They threw us down a little axe to cut steps, and put down the end of their poles, and we got out.

"'We all went to search for the three others: we sounded with our poles, we cried aloud, we called them by their names, put down a long pole into the snow and listened; but all was in vain, we heard not the slightest sound. We spent two hours in this melancholy search, and by this time were well nigh frozen, for the wind was bitterly cold, our poles covered with ice, our shoes frozen as hard as

horn. We were compelled to descend; we hurried down in perfect silence, and returned to the inn late at night.

"The three poor men were all unmarried. Pierre Cairriez was a blacksmith, and his family depended on him for their main support. Julien drew a very simple but touching picture of the scene of sorrow presented when the fatal news became known to the surviving friends. These rugged brave mountaineers would face death themselves unmoved, but it was with a low voice and a glistening eye that allusion was made to the fate of their comrades, and the grief it had occasioned. The two English gentlemen contributed very generously to the relief of the distressed families.

"Worthy Simeon confirmed his brother's narrative, and gave me all the particulars that fell under his own eye. He described most affectionately the despair of the bereaved friends. He tried to look perfectly unmoved, and seemed ashamed of his emotion. Yet this fine brave fellow could hardly keep from tears as he said, 'La mère de Pierre Balmat se désoloit. Trois mois après elle est morte.'

"Such is the abstract of the story. I have before me a simple but very intelligible sketch of the relative positions, which Julien made for me with his own hand, but it would be unsuitable to the present occasion, and we have already to apologize for so long a digression. This unhappy accident seems not to have been altogether what is commonly called an avalanche, but simply a part of the stratum of new snow which slipped upon the old, and swept all before it in its descent. The extent of snow put in motion was estimated at about 200 feet in height, 150 in breadth, and rather more than a foot in depth."

I now return to my own narrative. Saussure's course (80) lay to the west of the Rochers rouges (59); we went eastward of them, by the new route (79) discovered in 1827, when my fellow-countrymen C. Fellows and W. Hawes ascended, and by which a very dangerous part is avoided.

Great dryness, in some parts a livid colour, and constriction of the skin, now began to be observed; thirst became intense, and could scarcely be alleviated, though we continually

ate sugar, French plums, and snow. We were in a narrow valley, sheltered from the wind, and exposed to the sun's direct rays: the common focus, too, of rays reflected from vast surrounding walls of snow. The heat was therefore now oppressive, and the face scorched. A veil had been provided, but as it would have taken from the splendour of the icy scenery around, I preferred not using it, though desquamation of the epidermis of the face was almost sure to follow the omission. Green spectacles were used, and are indispensable, to obviate the glare from the snow.

An insect of the order Diptera was found dead upon the snow, about 1500 feet below the summit, and one of the Hymenoptera, alive, 300 feet higher; both having probably been carried up by the wind. Professor Bronn of Heidelberg, was so obliging as to examine these for me, and found the first to correspond most nearly with the description of *Syrphus arcuatus* of Fallén and Meigen. If it be really this, the vicinity of Mont Blanc is a new station for it, as, according to Meigen's monograph, it

had previously been found in Sweden only. On the day after my return from the mountain, I saw two or three of what appeared to be the same insects alive, near the "Jardin," about 9000 feet above the sea. They were extremely vigilant, and rapid on the wing: I could not catch one. The other insect has not been determined.

Two large birds were seen at a distance, passing over the shoulder of the mountain, from Piedmont to Savoy, at a height of nearly 15,000 feet. The guides called them "Corneilles." They were probably "Alpine crows"—"*Pyrrhocorax Pyrrhocorax*," Cuv.*

Our progress, after leaving the Grand Plateau (60), at first obstructed by the passage of some very formidable cliffs of ice, was hindered chiefly by the depth of the soft snow, until we reached the foot of an acclivity of nearly 45°, and many hundred feet in height. It was the "épaule droite" (or right shoulder) of the

* "*Corvus Pyrrhocorax*," Gmel.—"*Choquard* or *Choucas des Alpes*," Buff. Rarely leaving in summer the highest elevations of the Alps; always living in the neighbourhood of perpetual snows. Temminck.

"Calotte," or summit of the mountain. The surface here was so much indurated, as to prevent our advancing one step, without holes being first cut with the axe; yet it had not become so hard as to render firm the footing thus obtained. It was in the state compared by Auldjo to a "conglomerate of hailstones;" which, frequently and suddenly slipping back, precipitation would have been almost inevitable, but for the ropes holding us together. In no part of the ascent were the latter felt to be more indispensable than there. Our progress was extremely slow, so that I suffered not a little from the cold,—a keen breeze prevailing at the time; and as my feet seemed all but frozen, the footing became doubly insecure. There was a splendid prospect, had I dared to look below me; and once or twice a glimpse of it was obtained,—but attended with some giddiness, which made me glad to turn from it: and so near was the foot of the declivity to the margin of the steep glacier de la Brenva, that it seemed as if the momentum that would be acquired by a fall, would have been sufficient

to cast us down an unknown depth, on the Italian side.

Having at length scaled the " épaule droite," we had reached the height of 14,700 feet above the level of the sea.

SECOND LECTURE.

Sensations—Dryness of the skin—thirst—want of appetite—Breathing not affected, a thousand feet below the apex—Sudden exhaustion, and embarrassed respiration after a few steps—Exhaustion extreme—indifference—sinking upon the snow—The apex reached—uneasy sensations gone—Respiration not affected while at rest—Barometer—Thermometer—Evaporation a source of cold—Beverage—Thirst unquenchable—no appetite—A pistol fired—feeble report—Sound conducted by the ice—Height of the mountain—Apex how formed—Boiling point of water—Combustion of wood and charcoal—"Rochers Méridionales" "Derniers Rochers"—Specimens now in the Museum at Edinburgh—Snow does not deepen on the summit of Mont Blanc—Prospect from the summit—Thrill of exultation—Actual range of sight—Mountains—Plains and Valleys—Waters—View too vast for the human eye—The dark "aiguilles" in seas of snow—Tell—Columbus—Hannibal—Cæsar—Voltaire—Rousseau—Gibbon—Saussure—Beccaria—Couttet's sketch—Descent rapid—Danger of setting snow in motion—Respiration not disturbed in the descent—Lassitude—Mont Buet; death of Eschen there—Narrow escape on a thin crust of snow—Organ of hearing—Return to the Grand Mulet Rock—Barometer—Appetite returned—Another night upon the rock—Proposed cavity—Plants—Mica slate and gneiss—Final departure from the Grand Mulet Rock—The glacier recrossed—Danger from avalanches at the Aiguille du Midi—Anxiety of a brother—Our track followed from the Bréven—Jacques Balmat—Return in safety to the Priory—Three days without a cloud—Barometer—Supper with the guides and Jacques Balmat—Death of Jacques Balmat—Mine the sixteenth ascent—Certificate—Twenty persons—Count de Tilly—List of ascents—A state of collapse not perceived to follow—Do I recommend the ascent to others?—A mine of recollections.

SECOND LECTURE.

No sensations had been hitherto experienced, differing in *kind*, from those which had occurred to me in the ascent of less lofty mountains. Dryness of the skin and thirst, already mentioned, were to be expected, as the immediate consequences of increased evaporation from the surface of the body, and, in part, of dryness of the fauces (III). There was, however, want of appetite,—first perceived upon the Grand Plateau, two thousand feet lower down (IV). Breathing not at all disturbed.

We now stood above the "Rochers Rouges," on a small platform of snow, at the foot of the last slope. I suffered at this time only from thirst, and from the effect of warmth returning into my half-frozen feet. The condition of the

guides was not observed to differ from my own. There now remained less than a thousand feet, up what appeared an easy slope, (a plane of about 30°) to take us to the apex of the mountain. My enthusiasm was perhaps scarcely equal to what it had been three hours before.

Such were the circumstances under which we addressed ourselves to the last acclivity,—such our sensations;—and I was ready to believe, that I should experience no others.

Suddenly, however, as we approached the "Derniers Rochers," that project through the snow, near the middle of this the last slope, there occurred to me considerable exhaustion, —accompanied, but scarcely preceded, by dyspnœa (difficult breathing); both of which sensations, standing still for a few moments, and taking two or three deep inspirations, sufficed entirely to remove; but which, on my again setting forward, returned as before (V). At first this happened after perhaps every twenty, or five-and-twenty paces; but this number became less and less, until it did not amount to ten. Never have I found the flexors of the thigh, and extensors of the leg, so inadequate to the

performance of their office, as on that occasion; and yet I cannot say that seven hundred feet lower down (*i. e.* at the foot of this slope), I had been conscious of the least fatigue. My steps were now extremely short and slow; yet rest for a few moments, standing, continued to relieve me.

At length, exhaustion became extreme,—the magnitude of the undertaking ceased to be a stimulus,—and a degree of indifference came on, that deprived the highest point in Europe, though just within reach, of all its interest, and made me ready to ask myself, "cui bono?" Thus, almost fainting, I sank upon the snow. Yet, even now, rest for a few minutes, and a little wine, restored me, and one more effort being made, I stood upon the apex of the mountain (56). It was a quarter past two o'clock.

Again repose was taken: then—finding that there really was no higher point,—that the mountain-top was actually gained,—every uneasy sensation ceased; and during an hour and quarter, that I spent there in a state of comparative repose,—*i. e.* engaged only in making such observations as the few instruments

I happened to have with me, admitted of,—in endeavouring to ascertain the boiling-point of water,—and in contemplating the stupendous scene beneath,—my respiration was not at all affected, and I was inconvenienced only by the wind on that unsheltered icy ridge. Time appeared to pass, however, with amazing rapidity; which I attribute, partly to a degree of languor, rather inferred than felt, that made me longer than I was aware of in performing my experiments,—partly to the overpowering vastness of the prospect, in which I was, as it were, lost.

I found the height of the barometer = 17.052 Eng. inches,—suspended, and screened by the encasing wood from the sun's rays; the attached thermometer indicating 32° Fahr. a breeze blowing from the south. My air-thermometer proved bad; but with the mercury of the barometer at 32°, the air would be about 30°; and that stratum of it in contact with our bodies was of course lower, from the quantity of heat becoming by evaporation latent. I felt little or no desire to sleep; it would doubtless have been otherwise, with more intense cold.

One of my guides had headach, probably from rather a large quantity of brandy he had taken. The rest assured me individually, that they were well, and they all said that their breathing had not on this occasion, nor on any former one, been affected *while at rest* upon the summit. I may remark, that I did not find needful for myself, any stronger drink, during the whole journey, than a light wine of Neuchâtel. Lemonade and wine, so far from being loathed, as I understand to have been the case with some, were found most grateful; but thirst remained unquenchable. Disinclination to eat continued, yet did not amount to nausea (VI).

Saussure said that on the summit of Mont Blanc, the firing of a pistol would make no more noise than a small cracker in a chamber. I fired a pistol on that summit, and caused it to be fired a second time. The report was, indeed, each time extremely feeble; but losing especially in sharpness, it can scarcely be compared with that produced by the explosion of a cracker. I would say it resembled rather the report of a pistol, having the powder quite loose, *i. e.* not rammed.

The snow forming the last slope was indurated, and its surface glazed. When I was ascending this plane, some of the guides were in advance, by perhaps a hundred yards. I could have imagined that I heard oxen lowing at a distance. It was the creaking noise, produced by the points of the guides' bâtons in the hardened snow. Slight impulses, which the attenuated air would not have conveyed so far, being thus conducted undiminished by the ice; an effect favoured, too, by the stillness of those solitudes.

The height of the mountain, according to Saussure, is 14,700 French, or 15,666 English feet (one French foot being = 1.06575, or about $1\frac{1}{15}$ English). The apex is formed by indurated snow, lodged apparently between the apices of several aiguilles. The extreme apex, as I found it, was a ridge, nearly 200 feet in length, with scarcely any breadth; its direction east and west; the slope on the north side very rapid, that on the south more gradual: but its form is of course subject to frequent changes, depending much on the direction of the wind while snow is falling.

Saussure found the boiling-point of water on the summit of Mont Blanc to be 68°.993 R. (= 187°.234 F.), the barometer at 16 pouces $0\frac{144}{160}$ ligne (= 17.131 English inches), a spirit-lamp having been used in the experiment. I had provided wood and charcoal, for the same purpose; and these, with the aid of bellows, were kindled with less trouble than had been expected,—Couttet having told me that such materials were useless on the summit of Mont Blanc, and that no fire had been made there before.* Water was brought to ebullition, and the height of the mercury in a thermometer carefully observed, when it ceased to rise. The instrument was one procured at Chamonix, my own having been broken. Unfortunately, the scale was loose, and the graduation inaccurate, as since discovered,—so that I do not venture to state exactly the temperature observed by me; but I have no objection to say, that it did not very widely differ from, though it was ra-

* I have since found that Saussure had a charcoal fire made on the summit; but finding it very difficult to keep it up, he used it only to melt a little snow for beverage. Of the charcoal he says, that without the unceasing application of bellows, it was extinguished in a moment.

ther lower than, that indicated in the experiment of Saussure. The mercurial column on the two occasions was likewise about the same. Water then, because of diminished atmospheric pressure, boils at the summit of Mont Blanc at a temperature, about five-and-twenty degrees below its known boiling-point at the level of the sea.

While on the summit, Couttet fetched me specimens from the "Rochers Méridionales,"—the highest rocks on its south side. Two of these, A and B, may be reckoned among the granitoid rocks of Mont Blanc,—the protogyne of some French geologists. Another, C, is hornblende rock, traversed by veins of asbestus. There is also a compound of hornblende and felspar, having vesicles, probably of hornblende, vitrified by lightning, on its surface,—one of the "Rochers à bulles vitreuses" of Saussure.

In our way down, I procured specimens of the "Derniers Rochers," or "Rochers du Nord," E, two little masses, projecting a few feet through the snow, near the middle of the last slope,—and therefore just below the apex of

the mountain, on the north side. Fragments, doubtless broken off by lightning, lay strewn around them on the snow. At the time of Saussure's visit, these "Derniers Rochers" were the highest rocks that naturalists had examined; and his description of their composition was therefore most minute. He called them granites, but as mica is wanting,—being replaced by talc,—they are now more generally termed granitoid rocks, or protogyne (VII).

Specimens of most of these rocks, marked as above, are now in the Royal Museum of Natural History in the University of Edinburgh. They are interesting, as the highest rocks in Europe.

Saussure stated the dimensions of one of the "Derniers Rochers," to enable future travellers to ascertain whether snow increased in depth upon the summit. From what I recollect of this rock, it projected just about as much (four or five feet) when I saw it, as it did at the time of Saussure's visit, which was nearly half a century before; and I conclude, therefore, that snow does not, upon the whole, deepen on the summit of Mont Blanc.

As if reluctant to approach the subject, I have hitherto said nothing of the stupendous scene spread out beneath me, when upon the summit of the mountain. In truth, I may well be reluctant to approach it, and am not ashamed to own my utter inability to describe that, of which no words can fitly tell.

For, standing as I did on that mysterious "pyramid of frozen light" that Goethe saw,—and which he well nigh deemed some heavenly Pharos, shining with the stars,—where should I begin to represent a panorama, far beyond the boundaries of even eagle-vision?—how delineate a great half-moon, the Alps, reaching from Hungary to Southern France,—spanning at once the Mediterranean and the Adriatic Seas? If on the Col de Balme (9) I had no eye for details, how much more were they not inappreciable, from the centre of a circle, having for its radius more than 200 miles! Is it surprising, that in such a picture I was overwhelmed and lost?

Mine was a curious state, just as the apex of the mountain was attained. Now, utterly exhausted, gasping, fainting, caring nothing for

the spot on which I stood, sinking upon the snow. A few moments of repose, with normal breathing, and all the exhaustion, faintness, and indifference gone. Then scarcely crediting, but at length assured, that the mountain-top was really gained, receiving back my lost enthusiasm, and turning with a thrill of exultation never felt before, towards the unutterable greatness of the scene.

The actual range of sight, though limited by Alps in various directions, comprehends nearly all Sardinia, the western half of Switzerland, one-third of Lombardy, and an eighth of France. This immense extension, because of Alps, that bound it on the north-east and south-west, is really of an oval form; its longitudinal diameter reaching from Mont Morran in France, north-west, to the mountains of Tuscany, south-east.

I must not attempt more than a bare enumeration of some of the most striking objects.

And first, of mountains,—

Northwards,—in the foreground and below me, were the Bréven and the Aiguilles rouges

(1); then, beyond, the white dome of Buet, with other mountains of Savoy.

North-east,—the Diablerrets: further off, the Gemmi's bifid top; and then, in line, the other splendid snowy peaks of Berne; of which the Eiger, Jungfrau, and the highest of them all, the pointed Finster-aar-horn (the horn of the dark eagle), were perhaps the most distinct: those Bernese alps, which, seen from the summit of the near Faulhorn, had seemed so vast, now forming but an inconsiderable part of the mighty whole.

Southwards,—nearest, the Græcian alps, including the Little Saint Bernard, Mont Iséran, Mont Cenis; and separating Savoy and the Tarentaise, west, from Piedmont and Aosta, east. Then, south and south-west, the clustered Cottian Alps, Mont Viso, which gives rise to the river Pô, at their most southern end. Here began the Maritime Alps, which, extending still southwards, afterwards divide, sending one branch south-west into Provence, another south-east, terminating with the Col de Tende.

South-east,—the Apennines, in beautiful distinctness, though distant nearly a hundred and fifty miles.

East,—not the Great Saint Bernard,—for that mountain is not seen,—but just beyond it, Mont Vélan ; further off, the Matterhorn; and distant about fifty miles, a seven-pointed, crown-like mountain, with most enormous glaciers. It was Monte Rosa, seated majestically at the east extremity of the Pennine Alps,—the *Alpes Summæ*,—of which Mont Blanc occupies the western end. The former mountain takes its name, Welden thinks, from the rose tint, given peculiarly to it, from its situation, by the rising sun.

North of east,—the Furca, and the Saint Gothard.

West,—close below me, the Col de Bon-homme (74), and

North-west,—the whole chain of Jura, from end to end,—reaching from Lyons to Basle.

Of plains and valleys,—

North,—at my feet, the vale of Chamonix, with the Priory (48),—the latter distant two leagues and half, in a straight line; the valley winding north-westward, towards Servoz and Sallenche. Much further off,—between the chain of Jura, and the Bernese Alps,—the great vale of Switzerland.

South-east,—at the mountain's foot, Aosta ; much further off, the plains of Piedmont, bounded by the Apennines ; and beyond the latter, part of the coast of Genoa.

Further eastward, Lombardy; beyond which, the eye was lost in a vast blue space, that continues level to the gulf of Venice.

North-east,—part of the valley of the Rhone, walled by the Helvetian Alps.

West,—the plains of France.

Of waters.

North,—the silver Arve (49), winding through the vale of Chamonix,—then wending towards Geneva, where it pours itself into the Rhone.

North-west,—part of Lake Leman, like a crescentic pond, so small, and seeming not far off, though distant fifty miles. Its eastern half hidden by mountains of Savoy.

North—and further off, the Lake of Neuchâtel.

In the south-east,—the windings of the Pô and other streams; but not the Mediterranean Sea,—that is hidden, Welden says, by the heights of Cogne and Saone.

These are a small part only of the chief mountains, valleys, plains, and waters. How vast the sea of Alps, the names of whose waves I did not try to learn; with vales and rivers winding through them, seeming mere dells and brooks,—plains and lakes, that looked like fields and ponds.

The human eye, however, cannot appreciate the distant objects, and the nearer ones, unless lofty, can be but indistinctly traced, in such a field of view. I saw however, clearly, one range of mountains, more distant than any of those named: these were the heights of Tuscany, between which and my station there intervened about two hundred miles.

And all of this vast panorama was seen beneath a sky of ebony, in which *there was not visible a cloud.*

But not extent alone; the kind of scenery was wonderful: and there was no part of it that held the eye so much as the chain of Mont Blanc itself. Seven miles in breadth, and five-and-twenty long, a host of stern and rifted rocks, — the dark "Aiguilles," — projecting through seas of snow, and the bright whiteness

of "most resplendent glaciers;"* their inaccessible and needle-tops,—to which we had with dizziness looked up,—now, surmounted, far beneath our feet. We stood upon that placid pyramid, seen from the Col de Balme (9), enthroned and dominant among his vassal peaks; and, years which no man can number, holding his icy, silent, solitary reign.

The eye took in at once the chill abodes of unrelenting frost, and Italy's fair land, "where citrons bloom;" it turned from the frozen summits of the highest Alps, down to the velvet verdure of the vales.

Far in the north, there rose the mountains of the patriot Wilhelm Tell. South, hidden by the Apennines, and distant fifty leagues, the birthplace of Columbus; of whom Genoa may well be proud. In this direction lay Turin, stormed by the Carthaginian Hannibal;—in that, Chamberi, through which place Cæsar led his mailed legions, when first marching into Gaul. Here Voltaire had conceived and penned his dreadful blasphemies;—here a Rousseau,—and there a Gibbon wrote, and after having written the last

* Clissold.

sentence of his history, looked at the summit of Mont Blanc. Here was the Col du Géant, where the illustrious Saussure had sojourned fourteen days: I stood upon the spot, he mainly had been the means of man attaining. And there should stand Milan, the native city of Beccaria, through whose writings, I believe it was, that the great experiment was tried, for twenty years, in Tuscany,—proving that a bloodless might be an efficient code of laws.

Couttet afterwards shewed me a very tolerable sketch he had on a former occasion made, of the principal objects seen from the summit. He now has a Camera lucida, to use for the same purpose when again there; if, indeed, he reach that spot yet once more.*

We had all left the summit by half-past three,—several of the guides having descended sooner, a few hundred feet, to a more sheltered situation. I left it with extreme regret.

* Of the summit I have since had an excellent view from the mountain-road, between Neuchâtel and Basle; at three or four hours' ride from the former place: so distinct, indeed, as to admit of being sketched. This was at a distance of about thirty leagues in a straight line. De Saussure believed that he saw it from Dijon in France, distant fifty leagues.

The descent was rapid, and fearfully so at the "Epaule droite." The guides slid down whole fields of snow, supported by their bâtons.

While descending the slopes of ice above the Grand Plateau (60), I met with frequent and severe falls, from the new snow concealing their slippery surface; and as I more than once slipped down to near the margin of a precipice, this was not without its danger. But the guides very coolly drew me up again, and appeared to be alarmed only, lest the overhanging masses of snow should by these means be set in motion; for it happened just at a part where they were anxious to proceed as gently as possible,—scarcely venturing to speak aloud, —from its liability to avalanches, which were also very likely to occur at that time of the day (it was between four and five in the afternoon), and by which we might have had a recurrence of the fatal scene of 1820, already referred to, that took place at but a short distance from this spot.

In the descent, my respiration was not at all disturbed, nor, I believe, that of any of the guides. The only uneasiness affecting me,

commenced at about 2000 feet below the summit, where I became the subject of great lassitude, and frequently sank down upon the snow. It was natural that I should by this time have become weary, for the exertion had been long-continued and extraordinary: I had not had more, perhaps, than three hours of sound sleep the night before,—and the previously sustaining stimulus, the mountain-top, was now but a *retro*spective object, from which, too, every step removed me further.

Having twice named Mont Buet, I shall give Ebel's account of the melancholy scene, of which I have already called it a warning monument.

"In the year 1800, on the 7th of August, M. Eschen, a Dane, known in Germany by an excellent translation, in verse, of the odes of Horace, perished miserably upon this mountain. Having left Servoz in the evening with a fellow-traveller, he slept at the chalet of Villy. The next morning they ascended the Buet, with their guide. When they had arrived upon the glacier of snow, M. Eschen, who was some hundred paces in advance, suddenly

disappeared. His friend and the guide hastened back to obtain assistance, and the same night four men left Servoz to render it. They found the unfortunate Dane in a cleft of the glacier, 100 feet below the surface. He was in an upright posture" (I presume wedged in between the approximating sides of the chasm), "his arms above his head, and entirely frozen."*

Such might have been my fate also; for in passing over the hidden cavities we had crossed that morning, I stept into a hole concealed by snow. I was attached at this time to two guides,—the one preceding me, the other following. On being drawn out, I discovered that a mere crust, a few inches thick, was all that *still* separated me from a chasm, the depth of which could not be ascertained. It is not improbable that the extent of the cavity, in other directions, was in proportion to its depth; and that had more of the crust given way, my two nearest guides would have shared with me the consequences. This affords an example of the necessity for several persons

* Manuel du Voyageur en Suisse, traduit de l'Allemand, tom. ii. p. 239.

being constantly held together by means of ropes; though even this precaution might have here proved unavailing.

It appears to me that it is by the drifting of snow over the crevices, as it falls, that they become covered and concealed,—flake after flake first clinging, then freezing to the margin; and thus gradually roofing them with thin crusts.

Our descent of the steep declivities of snow was very rapid; and, from the experience of some, there might, in consequence, have been expected sensible pressure on the external surface of the membrane of the tympanum (the drum of the ear), before an equilibrium of atmospheric density was established by the Eustachian tube. This effect, however, was not observed.

We returned to the Grand Mulet by a quarter past six, *i. e.* in little more than one-fourth of the time it had taken to ascend from this rock to the summit. It was afterwards found that a spectator,—my relative, already mentioned,—descending from the Bréven, had, with the assistance of a glass, counted us,—seven in number,—into these our quarters for the night.

At half-past six o'clock, the barometer was = 21.225 inches English; its attached thermometer being = 44°.37 Fahr.

I saw from that rock another sunset. The sun's disk appeared, as noticed by others, very much smaller than when seen from lower regions.

A fire was again made,—the cabin reconstructed on the same ledge of rock as before,—we supped, finding our appetites to have returned, and retired to rest. The night before, as already mentioned, excitement had kept me much awake;—this night, I slept most soundly. Two of the guides again passed the night without a shelter, but without sustaining any harm. Had a storm arisen, it is probable that we should all have done the same,—for a gust of wind would have blown away the bâtons and sheet which formed our cabin.

As many of the attempted ascents of Mont Blanc have been unsuccessful from bad weather, extreme cold, or fatigue, it seems desirable that a more substantial shelter should be provided, into which a party could retire, for even a few days, if requisite: and it might be worth

the consideration of the Sardinian Government, to employ some men a month or two, in hewing out a cavity in the Grand Mulet Rock, for this purpose.

The next morning, 18th, on this rock, the barometer, at a quarter past six o'clock, stood at 21.198 inches English, the attached thermometer being = 39°.87 Fahr. Specimens were collected of a few plants growing here. The flowering plants were *Aretia alpina*, *Saxifraga bryoides*,—neither of them in flower,—*Poa laxa* and *nemoralis* (var. β ?),—both in fruit. Of the grasses, but a single tuft was found. Lichens, *Cornicularia lanata*, and *ochroleuca* ; and *Gyrophora polyphylla* (?). Mosses, *Sphagnum acutifolium*, and a species of *Grimmia*, *Trichostomum* (?), and *Eucalypta*.*

Specimens were taken of a mica-slate, containing cubes of iron-pyrites; and of gneiss with asbestus. A small bird was observed on the rock, but I did not see it. We were gratified, just before leaving the rock, with the sight

* Most of these plants were in a state in which it was not easy to determine them. I have been assisted in naming them by Professor Nees Von Esenbeck of Bonn, and by my friend Dr Greville of Edinburgh.

of a splendid avalanche, which occurred at a distance, as estimated by one of the guides, of "une demi-heure" (= $1\frac{1}{2}$ mile English); and in a few moments, a shower of ice particles, that resulted from it, reached us.

We left the Grand Mulet Rock at half-past seven A. M., and retraced our steps across the glacier, to the foot of the Aiguille du Midi (37). Here, numerous fragments of ice, very newly fallen, covered the ground for a considerable distance, and we tried to pass quickly over it, in dread of more; but these fragments served also to retard our progress.

Having safely recrossed the glacier, all serious danger was past. The undertaking had been well-timed: it was not until Saussure's *third* attempt, and after he had contemplated the ascent for six-and-twenty years, that he succeeded; and the indefatigable Bourrit was obliged to return *five* times unsuccessful, and never attained his object (IX).

Human forms were soon afterwards descried upon the rocks below Pierre à l'Echelle; and I had the satisfaction, truly not a small one, of

recognising among them my brother, who, accompanied by a man and boy, had ascended thus far to meet me. He, as well as others, had witnessed, from the Bréven, our arrival on the summit, and had seen us in different parts of the snowy track. His feelings, on first discovering us, which had been, as expected, a little before we reached the Grand Plateau (60), may be judged of, from the fact of his having, a few hours previously, observed a tremendous avalanche, near the Grand Mulet, just at the time when we were likely to be leaving that rock. In magnitude, it had resembled a city falling: the icy edifices first dashing fearfully down the glacier from side to side;—then buried in a cloud of particles, into which they had been shivered.

He was standing at one of the Hotel windows, at the time, with a telescope directed towards the rock. In a state of dreadful suspense, he then ascended the Bréven, from which the best view of our track was to be obtained. From a party that overtook him, he learnt that we had been seen from the valley. The question then was, in what direction we were moving. If upwards,

the presumption would be that we were all safe; for, of course, had any of the party perished, the rest would have returned. This, however, had not been ascertained. At length, he saw himself, by means of a telescope, two or three black points, so small that he compares them to the feet of ants. They were not likely to be chamois so high up on the snow. These points, if long watched, were observed to change their relative positions,—sometimes forming, together, a triangle,—sometimes a line,—sometimes disappearing behind the blocks of ice. There remained no doubt of its being our party; but it was not easy to determine whether our course was up or down,—there being no dark and fixed objects, with which to compare our elevation. At length, however, it became certain, that we were ascending,—a discovery most relieving. Our track was now followed, and finally we were seen to reach the summit.

Soon after re-entering the Forest of Pines, we met a mountain-girl, who had ascended thus far, (several thousand feet,) with refreshments for us.

It was very interesting to me, just before

reaching the valley, to meet with Jacques Balmat, mentioned in Note IX., now an old man of seventy-three.

At the village of Les Pélérins, several of my countrymen met and congratulated me on my safe return ; and as we passed through the valley, the cottage doors presented smiling countenances, that bespoke a heart-felt welcome, and feelings very different from those with which our departure had been witnessed three days before.

Between three and four o'clock in the afternoon, we arrived at the Priory (48), not having met with any accident, and having had three days, *during which I did not see, from zenith to horizon, a single cloud.*

The barometer brought down from Mont Blanc stood at 26.918 English inches at five P.M., the attached thermometer = 71°.37 F.

In the evening, the guides supped with me, my relative, and the venerable Jacques Balmat joining us. What a repast it was ! Jacques Balmat could tell of dangers, half a century gone by,—of a night spent in solitude, in a storm, upon the glacier,—of the exultation felt when

the summit was for the first time attained; the result of his own exertions. Couttet,—hurled into a crevice by an avalanche in 1820,—buried, and almost asphyxized, in the snow, when discovered and drawn out by a fellow-guide,* fallen into the same fissure,—had now stood on the summit for the ninth time: with him and Michel Balmat, more especially, I could converse of the dangers we had together shared, for they usually took immediate charge of me, when not required to go in advance of the party. It was Balmat who had given me the wine, when fainting on the last slope. Of Jean Tairraz I could say, that it was he who drew me out of the cavity into which I was falling, and that he made the fire, by which water was boiled on the summit. (He was very anxious that I should notice the latter in his certificate, which was done.) Tournier had had me in charge in some critical moments; Despland had assisted me in scaling

* Julien Devouassoud, a very distinguished guide, whose affecting relation of the catastrophe has been quoted above, from Dr Clarke's narrative. I regretted that his absence from Chamonix prevented my having his services.

t o hundred feet of the Grand Mulet; Pierre Tairraz had taken a fur covering for his feet during the night, at this rock, but wrapped it around my own. These brave Savoyards,—three days before, I had seen them for the first time; but our common dangers, our hair-breadth escapes, their true services, made my friendship towards them feel as of older date; and it was with not a little regret, that I bade them farewell!

I am grieved to learn, by a letter from Couttet, that the interesting old man, Jacques Balmat, is supposed to have perished on a mountain near the "Dent du Midi de Bex," whither he had gone in search of minerals.

It appeared by the list at the Priory, that mine was the sixteenth ascent, and later in the season, by seven days, than any former one. By the same document, I found myself to be the twentieth person (guides not included), and the twelfth Briton, who had reached the summit.* A certificate, from the Sardinian Go-

* One woman also has gained the summit; Maria "de Mont Blanc,—"still living, I believe, at Chamonix. She accompanied a party of guides.

vernment, of having accomplished the ascent, was, as is usual, received from the Syndic, or Magistrate of Chamonix, attested by the guides.*

* Extract from the Certificate:—

"Nous, Sindic de la Commune de Chamonix, province de Faucigny, Duché de Savoie, certifions et attestons à qui de droit, que Monsieur *Martin Barry*, Anglais, Docteur en Médecine ..... a fait l'ascension du Mont-Blanc, le dix-sept du Courant, accompagné des six guides de nommés Tairraz Jean Pierre, Couttet Joseph Marie, Balmat Jean Michel, Despland François, Tournier Simon, et Tairraz Jean. Qu'ils sont partis de Chamonix le seize du Courant pour aller coucher au *Grand Mulet*, et parvenus le lendemain, dix-sept du Courant, sur la *cime* du Mont-Blanc, à deux heures apres midi, avec un beau tems, où Mr le Docteur Barry est resté, accompagné de ses guides, plus d'une heure de tems, et où il a fait diverses expériences phisiques, et observations barométriques. Qu'ils sont successivement redéscendus coucher au Grand Mulet, où ils sont arrivés à sept heures du soir, et de retour ici aujourdhui à Chamonix à trois heures apres-midi, tous sains et saufs: que pendant leur ascension, ils ont continuellement été apergus et observés par la multitude des voyageurs qui se trouvaient à Chamonix, et par les habitants de la Commune, (même au moment où ils arrivèrent à la sommité de cette montagne dont l'élévation fait témérité (?) et la rend remarkable. * * * * * En témoignage de quoi nous lui avons délivré le présent, que nous avons signés, avec les six guides de Mr Barry."

CHAMONIX, *le* 18. 7. *bre.* 1834.

(Signed) *Couttet Joseph.*
Michel Balmat.
Jean Tairraz.
Simon Tournier.
François Despland.
Pierre Tairraz.

Le Sindic de Chamonix,
(Signed) COUTTET,
Sindic.

Of those who have reached the summit up to the present time, there appear to have been

1 Savoyard,
2 Swiss,
12 Britons,
1 Courlandais,
1 Hamburger,
1 Pole,
2 Americans :

In all, 20.

Count de Tilly, a French Nobleman, arrived at Chamonix three weeks afterwards. Hearing that the ascent had so recently been found practicable, and that no countryman of his had ever been up the mountain, he determined to make the attempt, and succeeded. As he remained but a few minutes on the summit, it is probable that the cold was very intense. In descending, his feet were frozen.

The Syndic of Chamonix has obligingly furnished me with a list of all those who have accomplished the ascent. I extract it from his letter :—

" *Etat de toutes les Ascensions qui ont eu lieu à la Cime du Mont Blanc.*

Date des Ascensions.				
1786,	Août	8.	Jacques Balmat (Guide of Chamonix)	de Chamonix.
			Le Docteur Paccard	,,
1787,	,,	3.	M. De Saussure	de Genève.
,,	,,	9.	Le Colonel Beaufoy	Anglais.
1788,	,,	5.	M. Woodley	,,
1802,	,,	10.	Baron Doorthesen	de Courlande.
			M. Forueret	de Lausanne.
1812,	Sept.	10.	M. Rhodas (Rodatz ?)	de Hambourg.
1818,	Août	4.	Le Comte de Matezesecki	Polonnais.
1819,	Juin	19.	Le Docteur Rensselaer	Américain.
			M. Howard	,,
,,	Août	13.	Le Capitaine Undrell	Anglais.
1822,	,,	18.	M. Fred. Clissold	,,
1823,	Sept.	4.	M. Jackson	,,
1825,	Août	26.	Le Docteur Edmund Clarke	,,
			Le Capitaine Markham Sherwill	,,
1827,	Juill,	25.	M. Chas. Fellowes	,,
			M. W. Hawes	,,
,,	Août	9.	M. J. Auldjo	Ecossais.
1830,	,,	3.	Le Capitaine Wilbraham	Anglais.
1834,	Sept.	17.	Le Docteur Martin Barry	,,
,,	Oct.	9.	Le Comte de Tilly	Français."

The distance walked, in ascending and descending Mont Blanc,—from the very zigzag course taken,—is computed at about a hundred miles; but I do not think it so much.

On the day after my return from the summit of Mont Blanc, I walked without much inconvenience, by Montanvert (31), to the Jardin, and back to the Priory (48), the same evening, —thus crossing and recrossing the Mer de Glace (30),—a distance said to be = about forty English miles; but this also must be an exagge-

rated estimate. Subsequently, all that I suffered from, was desquamation of part of the epidermis of the face (the effect of the desiccation spoken of before),* and some soreness of the lips, and around the nostrils. A state of collapse, which was to be expected, after such extraordinary exertions, was not perceived to follow.

For observations made with the barometer and thermometer, vide Note VIII.

It will be expected that I should now say, whether I recommend others to see for themselves those scenes, which I have been describing. If I say no, it may seem sinister counsel; for the interest of that summit is just inversely as the number who attain it: if I say yes, however, I must add, as a *sine quâ non*, the object should be a great one. Mine, I acknowledge, insufficiently provided as I was with instruments, was not commensurate with the great risk and danger to seven human lives.

Now, however, that the enterprise has been

* Possibly this excessive desiccation of the face might be prevented, on such an expedition, by using some unctuous matter during the journey.

accomplished, there remains a mine of recollections,—inexhaustible,—always at hand,—called up by slight associations,—yielding delight that is ever new. Even the hardships and the perils have their charms, in retrospect; the escapes, an interest proportioned to the danger. Held to the guides by ropes, trying each step, among narrow crevices and openings, concealed by recent snow,—clinging with arms and knees, to ice in motion,—walking on narrow and uncertain ridges, between dark chasms,—crossing, by frail ice-bridges, unfathomable depths,—retracing painfully taken steps,—now, by means of ropes, drawn up, and now let down a wall of ice,—listening, sleepless, the night through, to avalanches, such as might hurl us to destruction on the morrow,—toiling, dispirited, up a vast field of snow, the last forlorn hope,—sounding for a stepping-place, among the ice-rafters of unseen cavities,—parched with thirst that was unquenchable,—now oppressed with heat, now with feet half frozen,—the surface giving way, and thus ready to be cast down an unknown depth, at the "Epaule droite,"—fainting on the last

declivity,—slipping down to the margin of a precipice,—ready to disappear, through a thin and yielding crust of snow,—climbing over ice-debris, just fallen; that debris warning to hasten, yet stopping up the way;—those scenes are now unutterably interesting, to look back upon,—life-long sources of most grateful contemplation. And whether I behold the fairy structures on the glacier,—alps, far below me, glowing in the rosy, crimson, purple light of sunset—the mighty prospect from the summit, —or, more than them all, that moonlight, midnight hour and half of solitude upon the rock; —it is a picture of sublimest beauty, vivid and indestructible by time; but it is one that, not knowing how to paint for others, I must continue to enjoy alone.

NOTES.

I. Colour of the ice—the ice stratified—seracs.

II. Effect of contrast on the colour of the sky—cyanometer—a well-marked border to the darker blue.

III. Evaporation—sun's calorific power.

IV. Loss of appetite—thirst.

V. Boussingault—respiration.

VI. Experience of others in regard to the effect of an attenuated air on respiration—Great differences in this respect from unknown causes—Inhabitants of lofty regions—New comers at first affected—Respiration embarrassed by any great and sudden change in atmospheric density—Oxygen *received* and oxygen *absorbed*—Vicarious office of the liver—Rest, and muscular exertion—Gay-Lussac, balloon—Boussingault, impure air—objection to his analysis—Sensations experienced by some, much severer than mine—Hæmorrhages—cause of Hæmorrhages—Speaking at great heights.

VII. Brochant de Villiers on the granitoid rocks of Mont Blanc.

VIII. Observations with the barometer and thermometer.

IX. Early attempts to ascend Mont Blanc—1760 and 1761, Saussure promised a reward—1762, Pierre Simon made the first attempt—1775, four men by the mountain of La Côte—1783, three guides of Chamonix—same year, an attempt by Bourrit—1784, Bourrit—1785, Saussure, Bourrit, and Bourrit jun.—1786, six men of Chamonix—same year, *Jacques Balmat*, and Dr Paccard *succeeded, the first who reached the summit*—Saussure's attempt to follow their track—1787, Saussure's ascent—same year, another attempt by Bourrit—1788, Bourrit's fifth and last attempt, unsuccessful.

X. Narratives published,—Saussure,—Clissold, Clarke, Sherwill, Auldjo, Wilbraham.

NOTES.

(I.) The blue-green colour of the ice, when occurring in large masses,—a phenomenon, not less interesting than beautiful,—is here seen upon the grandest scale.

The ice is disposed in strata, which are compact in proportion to their depth; the lower being blue-green, solid ice,—the upper, nearly white, indurated snow. The lines of stratification mark intervals of time between deposits of snow; the latter becoming, by infiltration, converted into ice.

Masses of compact snow are met with, remarkably rectangular, sometimes almost cuboid in their form. These are called "seracs," from their resemblance to a kind of Swiss cheese, in shape.

(II.) The effect of contrast on the sky-blue is familiar, as produced by dense and bright white cumuli, the sails of a ship, and other objects;

but this effect becomes in proportion more remarkable, if, as in the lofty regions of Mont Blanc, the blue be already greatly deeper, and the observer immediately surrounded by vast walls of snow.

In like manner, red and green are heightened by being viewed together, and so are blue and yellow. There are circumstances also, under which the complementary colour of some of these is recognisable on other objects. Thus red clouds, or the roseate hue derived by glaciers from the setting sun, are sometimes seen to tinge, subjectively, the pale sky near the horizon, green.

Boussingault's observations * on the effect of snow upon the colour of the sky,—made in his attempted ascent of Chimborazo,—corroborate my own. Hence the value of the cyanometer above the snow-line, depends on a judicious choice of stations by the observer. The tint appeared to me to be influenced by the position of the sun, in relation to the snow-masses; *i. e.* by the angle of incidence of rays upon the surface of the latter: and, arrogant

as it may seem for me to say so, I cannot help thinking that some discrepancies in Saussure's results were referrible to this cause. It is deserving of remark, that the ebon sky of Mont Blanc did not pass gradually into the pale whitish-blue of the horizon; but terminated by a well-marked border, at some ten or twelve degrees above the latter: thus pointing out two contiguous strata of the atmosphere, in which there were suspended very different quantities of vapour.

(III.) Evaporation was augmented, partly by the diminished density of the air, partly by the greater heating power, at that height, of the sun's rays, as well direct, as those reflected from the snow. Professor Forbes has been so kind as to make known to me the results of his observations with the actinometer upon the Faulhorn; which shew, that in passing through a column of air of six thousand feet, at an obliquity of 45°, the sun's rays lose about one-fifth of their calorific power; and that, therefore, at the summit of Mont Blanc, they communicate about 1.4 ($1\frac{4}{10}$) as much heat as at the level of the sea, at a vertical incidence.

(IV.) This loss of appetite resulted probably from sympathy between the stomach and the surface of the body (the latter having been affected first); and a deficiency or vitiation of the secretions of the stomach, was doubtless the chief cause of thirst,—sympathetically referrible to the fauces.

(V.) Boussingault and Hall in their attempted ascent of Chimborazo, experienced at a great elevation an unusual difficulty of breathing and weakness, so long as they ascended; but got free of this when they ceased moving. It is added, "when we sat down, we believed that we were in our usual state of health." They had, however, long resided in the high-lying towns of the Andes.*

(VI.) Nearly all of those who have ascended Mont Blanc,—of whose sensations we have any record,—seem to have been affected more than I was by Dyspnœa. Saussure † found it difficult from this cause, to make the exertion requisite, in the use of his instruments of me-

* Ed. New Phil. Journal, April–July, 1835.

† Voyages dans les Alpes, tom. vii. p. 231.

teorology, on one of the Plateaus, 3000 feet below the summit; and his guides became so soon exhausted, on attempting to excavate the snow, that Saussure says they had from moment to moment to relieve each other. The sufferings of Beaufoy, Clarke, Sherwill, and others, might be here mentioned. On the other hand, Clissold, * as well as one of his guides, reached the summit of this mountain, without being at all affected in their respiration: while the rest of the party suffered severely from this cause: and yet, the guide who was not at all incommoded on that occasion, is said to have undergone, on a former one, much suffering in this way, 5000 feet below the summit. There is a gentle inclination (I found it under 20°) from the extreme edge of the ridge, forming the apex of the mountain, to the "Rochers Méridionales,"—the highest rocks on the south side. Clissold says he "felt not the least ill consequence," from running a considerable way down this plane; while one of his guides, walking only, was obliged to lie down. Saussure's leading guide,—Balmat, "*le Mont Blanc*,"—when running to procure

* Narrative of an Ascent, &c. Aug. 1822.

specimens from the same rocks, fell, and was obliged to remain down some time, to recover his respiration. One of my guides, a robust young man of about twenty, reached the apex ten minutes before any others of the party, and seemed little, if at all, affected in this way. It was his first ascent;—he was enthusiastic;—and hence perhaps, the cause, in part, of his exemption. I believe that all the rest of my guides suffered, though some of them less severely than myself. "Lieut. Gerard * reached the Himalayan heights of 16,921,—18,943, and 19,411 feet above the sea, respectively, at three different times. In each instance, the ascent was upwards of 7000 feet above their encampment. During these journeys, his party felt extreme fatigue, debility, and severe headach. Previously, the party had been travelling, for several weeks, ten and twelve hours per day. Nothing is here said of respiration."

It would seem then, that while some have suffered more than myself, from embarrassed respiration, others have suffered much less; that there have been differences in this respect,

* Transactions of the Geological Society, New Series, vol. i.

not only among individuals of the same party, at the same time, but in the same person, at different times. How far referrible to the condition of the system, and how far, to atmospheric changes, is still uncertain. I have been endeavouring to construct a table, that should shew, in columns, the amount of coincidence between the sensations felt, by a great number of travellers, on high mountains, and some of the attendant, more or less influencing, circumstances; in which latter would be included, besides pressure and temperature of the atmosphere, also its hygrometric and electric states, the wind, latitude, elevation, season, time of day, kind of surface travelled over, age and habit of body of the traveller, &c.;—but the data have been found insufficient, and the attempt has for the present failed. Yet until such data are furnished, it will not be easy to arrive at any satisfactory conclusions.

We know that in some parts of the world, the inhabitants continually breathe an atmosphere not denser, and even more rare, than that at the summit of Mont Blanc; using also continued muscular exertions, which necessarily accelerate the breathing. Chicoito had

formerly a population of 30,000 souls; and is seated several hundred feet higher than the Grand Plateau. Potosi, in Peru, is equal in elevation to the Jungfrau. "The lowest part of the table-land, or plain of Thibet, is 14,924 feet above the level of the sea. Through this rolls the Sutledge, and it abounds in the finest pastures, and myriads of quadrupeds. Considerably above this part of the bed of the Sutledge, is situated the town of Daba, which appears to be tenanted in all seasons."*

Boussingault † mentions the strength and wonderful activity of the Torcadores, in bull-fights at Quito, 3000 mêtres above the sea; and that he has seen young and delicate females, dancing the night through, at places nearly as high as Mont Blanc.

The celebrated battle of Pichincha was fought nearly at the height of Monte Rosa. There is a village at the Nitee Ghaut pass, in the Himalayan mountains, not less than 16,000 feet above the level of the sea;—thus nearly 5000 feet above the height, at which some guides have been known to "fall down

* Quarterly Review, vol. xxii.

† Ed. New Phil. Jour. April-July, 1836.

from exhaustion, in ascending Mont Blanc."—*(Clissold.)*

New comers into these lofty regions are at first affected; and so are the inhabitants themselves, if they ascend to certain heights beyond. We have instances too, of those living at great elevations, being incommoded on their descending to lower levels. The diving-bell also, affords examples of inconvenience resulting from increased atmospheric density.

Thus, respiration becomes embarrassed, by any great and sudden change of density,—whether by increase or diminution,—in the medium through which it is performed. The minimum of density, at which this function would become, by habit, possible,—we do not yet know.

In my case, a reduction of more than one-third,* in atmospheric density,—the intermediate pressures having been passed through in the ascent,—(temperature of the air about 30° F.) was not found to incommode respiration, *when I was at rest;* it admitted too of slight exertion on a horizontal surface, and of

* Barometer at Chamonix, say twenty-seven inches Eng. —at the summit of Mont Blanc, say seventeen;—difference = $\frac{10}{27}$, or more than one-third.

walking down hill; neither of which so much quickened the circulation, but that the supply of oxygen was still equal to the demand; at least there occurred no immediate manifestation of deficiency.* But the efforts requisite in walking up a plane of about 30°,—its surface glazed, and therefore requiring extra muscular exertion to prevent slipping,—were sufficient, in that atmosphere, to produce, suddenly, the sensations I have mentioned: the severity of which became rapidly augmented, not so much, I apprehend, from a further attenuation of the air, the higher we ascended, as from the accumulating consequences of its first-perceived tenuity.

There is reason to believe that the quantity of oxygen *absorbed* by the lungs, does not always bear the same ratio to the quantity *re-*

* Gay-Lussac, in a balloon, reached the height of three-and-twenty thousand feet,—the barometer at little more than twelve inches,—without experiencing sensations, to be compared in their severity, with those sometimes produced, with muscular exertion, at little more than half this elevation. He suffered from cold, accelerated pulse, and respiration; and his throat became parched, he says, from inhaling the attenuated air. Now he was in a state of rest. His respiration then, would be the function first affected: it would be quickened, to make up in volume, what the air had lost in density; and accelerated circulation naturally, and in the same proportion, followed.

ceived into their cells. If the evolution of animal heat is directly as the oxygen *absorbed*, it certainly does not. For on this supposition, —the air at Chamonix having a density = 27, that at the summit of Mont Blanc = 17, and the temperature at the upper station being many degrees below that at the lower,—the absorption of oxygen must have been,—not relatively alone, but also,—absolutely greater, from the rarer, than from the denser air. (The temperature of the air at Chamonix was more than twice as high as that at the summit of Mont Blanc.)

But the quantity of carbon excreted by the lungs, is directly as the quantity of oxygen absorbed by the same organ. If therefore the pulmonary absorption of oxygen is reduced, the carbon must find an outlet through some other channel. Such an emunctory for carbon seems provided in the liver; this organ being obviously vicarious of the lungs,—though it is by degrees only, that it assumes this office.

Hence perhaps it is, that the liver often becomes hypertrophied, by circumstances that diminish consumption of oxygen by the lungs; as, for example, change from a cold to a hot

climate: and the human fœtus in utero, as well as many of the lower animals, present examples of the size of the one organ being almost inversely as that of the other. It would be interesting to determine, whether the liver, upon the whole, is larger in the inhabitants of the torrid, than in those of temperate and frigid zones. We should not expect to find it larger, in those who inhabit elevated regions; because the difference in the temperature of the air generally compensates for the difference in its density; and, by increasing the pulmonary absorption of oxygen, it increases also, the pulmonary,—and therefore renders needless the vicarious hepatic,—excretion of carbon.

Boussingault, † having found ascending to the same height on snow, more oppressive than on naked rock,—and having suffered too from difficult breathing, when the sun was shining on the snow,—imagines that an impure air is evolved from the latter; and regards an analysis he made, of air which he had tried to procure from the interstices of snow on Chimborazo, as a confirmation of re-

† Ed. New Phil. Jour. April—July, 1835.

sults obtained by Saussure; who supposed that the air of mountain-snow contained less oxygen than common air. Boussingault admits, however, that his own mode of obtaining air from the pores of snow, was such as to subject it to adulteration. His analysis therefore is not of much value: and as to the greater difficulty of breathing, which he experienced in ascending on snow, than on naked rock, it may have been the effect of a more accelerated circulation; the latter being caused, —if the snow were soft, by the muscular exertion required in wading through it,—if hard, by the efforts requisite to prevent slipping.

How much severer than mine, were the sensations experienced by some of the nineteen who had reached the summit of Mont Blanc before me, as well as those encountered by some travellers, on other mountains.

Colonel Beaufoy had violent palpitations,—his guides excessive vomiting.

Count de Lusi (who did not reach quite the summit) says, three of his guides bled freely from the nose, and one from the mouth;—two of the party complained of nausea, and of considerable inclination to sleep.

Dr Clarke says, "one of the guides had some hæmorrhage, from an accidental blow,—not from simple rarefaction of the air. The blood appeared to me decidedly of a darker colour than natural. I had a slight tendency to nausea, most overwhelming headache, some pain of the breast, and rather feared the rupture of a bloodvessel,—having been subject to hæmoptysis when a boy; but this pain, and the rapid beating of the heart, went off when we stopped to rest."

Fellowes says, "the noses of several of our guides burst out with blood; the eyes of all were bloodshot."*

Auldjo was half dragged, half carried, by his guides.

Zumstein suffered from hæmorrhage on Monte Rosa.

Bouguer had several hæmorrhages on the Cordilleras of Quito.

Humboldt and Bonpland, on Chimborazo, felt a tendency to vomit; and blood oozed from the eyes, lips, and gums.

Boussingault mentions hæmorrhage, as having been produced on the same mountain, in

* Unpublished Narrative.

his Indian guide, on calling aloud to his companion.

The occurrence of hæmorrhages, in the ascent of high mountains, has thus been a frequent, but very variable phenomenon. Some of those now mentioned, were probably mechanical effects of the internal and external pressures not being at first in equilibrio. The other symptoms differ from my own in degree, rather than in kind.

It is known that speaking aloud at great heights is difficult: an example too, has been afforded, where calling aloud was followed by hæmorrhage. It must not however be forgotten, that air losing in density, loses also its power of conducting sound; and therefore, that speaking at such heights may be more forcible than it seems.

Abstract View of the Effects of Diminished Atmospheric Density on Respiration, and other Functions; experienced by Dr Barry in his Ascent of Mont Blanc.

Height above the Sea, in Eng. Feet.	SENSATIONS.	REMARKS.
	In the Ascent,—	
12,000	Great dryness,—in some parts a livid colour,—and constriction of the skin.	Evaporation was increased, by diminished atmospheric density, and by greater calorific power of the sun's rays.
	Intense thirst.	
	Incipient loss of appetite.	
14,700	Loss of appetite complete. (Fatigue not felt).	
15,000	Some exhaustion. Breathing difficult. — Coming on suddenly, after 20–30 steps, up a plane of 30°, of indurated snow, having a slippery surface.	The circulation being so much accelerated, that the supply of oxygen was insufficient.
	These effects ceased, on standing still, and taking two or three deep inspirations. . . .	Loss in density being compensated by volume of air inspired.

15,500	Exhaustion extreme. . . Breathing more difficult. . A tendency to syncope (fainting). Utter indifference. . . } After less than 10 slowly taken steps, up the same plane of snow.	Caused, not so much by a further diminished density of the air, as by an accumulation of the consequences of its first-perceived tenuity.
	These effects ceasing, after a few minutes of rest, and inspiring deeply, as before.	
	On the Summit,—	
15,666.	Breathing not at all affected, during an hour and quarter at rest, or when taking moderate exercise on a horizontal surface.	Barom. 17.052. Air-Therm. about 30° F.
	In the Descent,—	
	Breathing not at all disturbed, although there was considerable muscular exertion.	The circulation not so much accelerated, but that the supply of oxygen was sufficient.
14,000	Considerable lassitude.	
10,000	Appetite returned. Thirst continued.	
	Subsequently,— A state of collapse not observed to follow.	

(VII.) Brochant de Villiers * objects to a name (protogyne) implying priority of formation. His conclusions regarding these rocks are as follows :—

1*stly*, That the granitoid rocks of Mont Blanc, and other similar ones of the high summits of the Alps (from Mont Cenis to the Saint-Gothard), are not granites ;—and that, consequently, it does not appear that there is in these high summits a formation, properly called granite.

2*dly*, That these granitoid rocks are only extreme varieties (more crystalline and more abundant in felspar), of a felsparry, talcaceous rock, much more abundant in the Alps,—and with which they are found united.

3*dly*, That this talcaceous rock,—equally associated with other talcaceous rocks,—constitutes a particular, and rather compound, formation,—which predominates in a great part of the Alps.

4*thly*, That the metallic ores are found almost always in *beds*, in this formation.

5*thly*, That there exists in the Alps, a true formation of granite, on the southern border of

* Annales des Mines, Tom. 4.

the chain; which, according to analogy, founded on all the facts at present received in geology, contributes, with all the preceding characters, to establish the *relatively inferior age of the pretended granites of Mont Blanc, and of the high Alps,—as well as that of the talcaceous formations, of which they constitute a part.*

(VIII.) The barometrical and thermometrical observations at the several stations mentioned, as well as those made at Geneva, and at the Hospice of the Great St Bernard,* on

* The observations made at the Hospice of the Great St Bernard, and at Geneva, on the 17th, were politely furnished me by Professor Maurice, principal editor of the "Bibliothèque Universelle," Geneva. For the sake of uniformity, I have reduced the barometrical measurements, from French pouces, lignes, and decimals, to English inches and decimals; and the thermometrical, from degrees of Réaumur, to those of Fahrenheit. Perhaps, however, Geneva is too distant a station, as long ago foreseen by Sir George Schuckburgh. It is a remarkable fact, that the *average* differences between the mercurial column at the Hospice of the Great St Bernard, and that at Geneva, are far from uniform from time to time, although these averages are deduced from observations of twelve months,—a period sufficiently long, one may suppose, to compensate the effect of any possible error. I am informed by a relative of mine, that the comparative heights of the mercury at these two stations, for ten years, as given in the Bibliothèque Universelle for 1833, tome 1. pp. 27. and 32,—both having been by him reduced to the decimal fractions of a "ligne,"—appear to be as follow; their differen-

the 17th September, are given in the following table.

			Barometer. Eng. Inches.	Thermometer. attached.
Mont Blanc.	Summit, Sept. 17, P. M.	$2\frac{1}{2}$	17.052	32°.00 F.
...	Grand Mulet " 16, "	$6\frac{3}{4}$	21.235	45°.50 "
	" 17, "	$6\frac{1}{2}$	21.225	44°.37 "
	" 18, A. M.	$6\frac{1}{4}$	21.198	39°.87 "
Priory.	Chamonix, " 18, P. M. 5 (After descent from M. Blanc)		26.918	71°.37 "
	Jardin, " 19, P. M. 3		22.034	58°.44 "
	Montanvert, " 19, " 8		24.334	61°.25 "
Priory.	Chamonix, " 19, " 11 (After returning from Jardin)		26.973	64°.62 "
Great St Bernard.	" 17, A. M. 9		22.717	59°.45 "
	" 17, NOON.		22.717	61°.25 "
	" 17, P. M. 3		22.700	61°.47 "
Geneva.	" 17, A. M. 9		28.962	72°.50 "
	" 17, NOON,		28.962	78°.11 "
	" 17, P. M. 3		28.930	78°.11 "

The barometer employed for these observations was an excellent one by Gourdon, Geneva. Its graduation was according to the French scale, but the observations are here,

ces, it will be seen,—inserted in the last column,—are not a uniform quantity.

Year.	Geneva. Pouce.	Ligne.	Great St Bernard. Pouce.	Ligne.		Mean Annual Difference. Pouce.	Ligne.
1823	26	10.73	20	9.32	=	6	1.41
1824	26	10.98	20	9.54	=	6	1.44
1825	26	11.55	20	9.49	=	6	2.06
1826	26	9.93	20	9.79	=	6	0.14
1827	26	10.65	20	9.20	=	6	1.45
1828	26	11.10	20	9.74	=	6	1.36
1829	26	10.30	20	9.63	=	6	0.67
1830	26	10.91	20	10.59	=	6	0.32
1831	26	10.65	20	10.30	=	6	0.35
1832	26	11.48	20	11.07	=	6	0.41

for the reader's convenience, reduced to English inches. The instrument was suspended at a height to suit the eye, and shaded from the sun as already mentioned. It is to be regretted, that the suddenness of my ascent of the mountain,—tempted as I was at its base, by the fineness of the season,—precluded me from obtaining additional instruments, with which the data might have been completed, for repeating the calculations of preceding travellers, as to the height of Mont Blanc.

(IX.) The following is a short account of the early attempts to ascend Mont Blanc. It is derived chiefly from the writings of Saussure and Ebel :—

Notwithstanding the great extent of this mountain, it can be approached from scarcely any side. On the south, south-west, and south-east, vast walls of rocks,—abrupt, and many thousand feet in height,—render it absolutely inaccessible; on the north, north-east, and north-west, it is surrounded by monstrous glaciers, walls of ice, precipices, and treacherous snows.

In 1760 and 1761, Saussure promised a considerable reward to those who should dis-

cover any way, by which it might be possible to attain the summit; offering even day-wages to those whose attempts should be unsuccessful.

In 1762, *Pierre Simon, of Chamonix, made the first attempt*, by the glacier des Bossons (62), and also by that of Tacul; but without success.

In 1775, four men tried it by the mountain of la Côte (64), which lies between the glaciers of Bossons (62) and Taconnaz (65). They then entered a great snow-valley, which appeared to lead directly to the summit. Everything seemed to promise them success; they had the finest weather,—they met with neither too broad fissures, nor too steep acclivities. But the sun's rays, reflected from the snow, and the "stagnation of the air" in that valley, caused them to experience, they said, a suffocating heat,—and gave them at the same time such a distaste for their provisions, that, overcome with fasting and fatigue, they had to retrace their steps, without having encountered any visible and insurmountable obstacle. It appeared too, that they had made great efforts; from the effects of which, they all subsequently suffered.

In 1783, another attempt was made by three guides of Chamonix ;* who, following the same route, passed a night on the mountain of la Côte (64), traversed the glacier, and proceeded up the same valley of snow. They had reached a tolerable height, when one of them,—the most hardy and robust of the three,—was seized almost suddenly, with a desire to sleep, that was irresistible. He wished the others to leave him, and go forward ; but, persuaded that he would, in such case, " die of a coup de soleil," they preferred to abandon the enterprise, and returned. They were all excessively oppressed by the heat,—had no inclination to eat, —and, what is remarkable, none for wine. One of them† seriously told Saussure, that it was useless to carry any provisions on this journey ; and that if he had to go again, he would take nothing but a parasol, and a bottle of scent. " When," says Saussure, " I imagined this great and robust mountaineer ascending those snows, holding in one hand a parasol, and in the other a bottle of " eau sans pareille," it ap-

* Jean Marie Couttet,—Lombard Menier, called " Jorasse," —and Joseph Carrier.

† Jorasse.

peared so strange and ridiculous, that nothing could have presented more forcibly, the difficulty of this enterprise,—and consequently the absolute impossibility of success, for men who have neither the head nor the legs of a good guide of Chamonix."

Nevertheless, the naturalist Bourrit, of Geneva, tried it at the end of the same season, 1783; but was driven back by a storm. "For my part," says Saussure, "after the information I had received from those who had attacked the mountain from that side, I regarded success as absolutely impossible; and it was the opinion of all the 'gens sensés' of Chamonix."

The year following, 1784, in September, Bourrit endeavoured to ascend the mountain from the western side; but extreme cold and fatigue overcame him. Two of his guides, however, Chamois hunters,* continued to ascend. Bourrit saw them in the midst of the high snows; and on their return, they declared that they had proceeded to within 60 toises (nearly 400 Eng. feet) of the highest point.

In 1785, Saussure, Bourrit, and the son of

* Marie Couttet, and François Cuidet.

the latter, made a new attempt, attended by 15 guides. They set off in September from Bionassay, and directed their course north-east, by Pierre-ronde, to the foot of the Aiguille du Goûté (58); where they passed the night. The next day, they ascended this aiguille: but the snow was so soft, that they could not proceed further. The heat was insupportable, although the thermometer in the shade indicated only 2°.5, and in the sun, not more than 4°.7 Réaumur (?) (= 37°.6 and 42°.5 Fahrenheit).

In 1786, in the month of June, six men of Chamonix attempted it; but fatigue and other circumstances constrained them to renounce the enterprise. One of them, JACQUES BALMAT,—in quest of minerals on a rock, projecting through the snow,—strayed from the party, and was obliged to pass the night alone, in a storm upon the glacier. The vigour of youth saved his life. In the morning, he perceived the summit at no great distance; and, by perseverance that was wonderful, found out a way by which it appeared to him accessible.

Jacques Balmat and Dr Paccard, were the first who attained the summit of Mont Blanc. This was in the same year (1786). On the 7th of

August, they set off together from Chamonix, and proceeded to the top of the mountain of la Côte (64); where they passed the night. The following day, at 4 A. M., they entered upon the fields of ice. At 3 P. M. they were still ignoant what would be the success of their enterprise. The Doctor was greatly affected by fatigue and cold; and Balmat did not cease to encourage him. At length, they perceived yet a summit above them, without knowing whether it was the last or not. At half-past 6, they attained the most elevated point, in sight of all Chamonix, and of many strangers, who followed their track, by means of telescopes. At 7, they quitted the summit,—reached at midnight the mountain of la Côte (64), their resting place the night before,—where they now took two hours of repose; and arrived at Chamonix (48), at 8 in the morning of the 9th,—after having passed twenty successive hours on the ice; their faces greatly swollen, and their eyes in very bad condition. The King of Sardinia made Balmat a present; and M. de Gersdorf,—a Saxon gentleman then at Chamonix,—on returning home, raised a subscription, and sent to M. Bourrit 17 Louis for

Balmat; who has been surnamed "Mont Blanc."

The illustrious Saussure attempted, immediately afterwards, to follow the track of the brave Balmat, and Dr Paccard. He set off for la Côte (64), accompanied by 17 guides; but was driven back by bad weather.

The following year, 1787, Saussure, having previously engaged Balmat to reconnoitre the state of the ice, left Chamonix at 7 A. M., on the 1st of August, with a servant and eighteen guides (of whom Jacques Balmat was the principal), provided with instruments, a tent, a bed, ladders, ropes, provisions, straw, &c. The party passed the night upon the mountain of la Côte (64). The next day, at 4 P. M. they reached the middle Plateau,—passing there the second night,—and set forward again the next morning. At 8 A. M. August 3, all Chamonix saw the party advancing towards the last heights; and all the bells in the village were rung, when the summit was attained. Madame de Saussure and her two sisters followed the track of the naturalist, by means of telescopes.

M. Bourrit set off immediately, but bad weather drove him back.

The following year, 1788, M. Bourrit made yet another trial, with his son and Messrs Woodley and Camper; the former English, the latter Dutch. Woodley alone reached the summit, but had both his hands and feet frozen: this happened also to the fingers and toes of others of the party. Thus, it appears that Bourrit himself never attained the summit of the mountain; though it would seem to have been partly through his indefatigable zeal, that Saussure was induced to persevere.

(X.) At page 82, a list is given of the successful ascents. Saussure's "Voyages dans les Alpes" contain a minute account of the natural history of the mountain, as well as of his ascent, and experiments, performed on its summit, and at the Col du Géant. Of the later ascents, several narratives have been published, viz.

"Fred. Clissold, Ascent, &c. Aug. 18. 1822: with an Appendix upon the sensations experienced at great elevations. The profits of the

sale to be applied to the benefit of the guides of Chamouni. London: Rivingtons, 1823." I have read this narrative with the deepest interest, but am sorry to say it is out of print. The author and his guides slept on the Rochers Rouges, 14,700 feet above the sea, and within 1000 feet of the apex of the mountain; being, I presume, the highest point,—more than 6000 feet,—at which a night is known to have been passed above the snow-line.

Dr Clarke and Captain Sherwill each published an account of the ascent they together made in 1825. They are highly interesting narratives; but, I fear, both out of print. Captain Sherwill has published also a "brief historical sketch of the valley of Chamouni. Paris, 1832."

Auldjo's "Narrative of an ascent, &c. Aug. 9. 1827," is well known; having deservedly had a wide circulation.

Captain Wilbraham published, I believe, in the "Keepsake" annual for 1832, an account of his ascent in 1830.

INDEX

TO THE

CHAIN OF MONT BLANC,

From the Summit of the Bréven.

---

1 Aiguilles Rouges.
2 Chalet of La Flégère.
3 Chalets of La Charlanoz.
4 Chalets of Planprat.
5 Path from Planprat to the Priory.
6 Les Escaliers.
7 Mountains of the northern chain of the "Vallais."
8 Rocks at the Croix de Fer.
9 The Col de Balme, 7551 feet.*
10 Chalets of Charamillan.
11 Village of Tour.
12 Aiguille du Tour.
13 Glacier du Tour.
14 Aiguille du Chardonnet.
15 Aiguille d'Argentière, 12,334 feet.
16 Glacier d'Argentière.
17 Aiguille Verte.
18 Aiguille du Dru.
19 Aiguille du Moine.
20 Glacier du Nant Blanc.
21 Aiguille du Bochard.
22 Le Chapeau.
23 Village of Lavanché.
24 Les Tines.
25 Village of Bois.
26 Village of Prats.
27 Source of the river Arveiron.
28 Glacier des Bois.
29 Rocks called Des Mottets.
30 The Mer de Glace.
31 The "Hospice" of Montanvert, 6100 feet.
32 Aiguilles de Léchand.
33 Aiguille de Charmoz, or d'Entre-la-Porte.
34 Aiguilles des Grandes Jorasses.
35 Aiguille du Greppond.
36 Aiguille de Blaitière, or du Plan.
37 Aiguille du Midi, 12,846 feet.
38 Glacier des Pélérins.
39 Glacier de Blaitière.
40 Glacier du Greppond.

* Above the level of the sea.

41 Le Plan de l'Aiguille.
42 Upper Chalets of Blaitière.
43 Chalets called "Sur le Rocher."
44 Path on Montanvert.
45 Path of la Filia.
46 The Hamlet of Planaz.
47 Village of Mouilles.
48 The Priory or Town of Chamonix, 3363 feet.
49 The river Arve.
50 Village of Favrans.
51 Village of Pélérins.
52 Cascade of Pélérins.
53 Bridge of Piralota.
54 Mont Blanc du Tacul.
55 Aiguille Sans Nom.
56 Mont Blanc, 15,666 feet.
57 Dôme du Goûté.
58 Aiguille du Goûté.
59 The Rochers Rouges.
60 The Grand Plateau.
61 The rocks called the Grand and Petit Mulet.
62 Glacier des Bossons.
63 Village of Bossons.
64 Mountain of La Côte.
65 Glacier de Taconnaz.
66 Mountain Des Fcaux, or of Taconnaz.
67 Mountain of La Gria.
68 Pierre Ronde.
69 Mont Lacha.
70 Aiguille de Bionassay.
71 Mont Blanc St Gervais.
72 Glacier de Bionassay.
73 Mountain of Tricot.
74 Aiguille de Rousselette, on the Col du Bonhomme.
75 Lake on the Bréven.
76 The Pavilion of Bellevue, above the Col de Voza.
77 Village of Molaz.
78 Route to the Grand Plateau.
79 New track from the Grand Plateau to the foot of the last slope.
80 Old track.

CHAIN OF MONT BLANC,

From the Summit of the Breven

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